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**A Manual of  
MARSH and AQUATIC  
VASCULAR PLANTS  
of NORTH CAROLINA  
With Habitat Data**

MAR 26 1977

**by Ernest O. Beal**

Illustrated by  
**Sara Fish Brown**

**North Carolina Agricultural Experiment Station**



**A Manual of MARSH AND  
AQUATIC VASCULAR PLANTS  
OF NORTH CAROLINA  
With Habitat Data**

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**Published by**

**The North Carolina Agricultural Experiment Station**



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To  
My Wife  
Sara Fromm Beal  
in memory of  
our son  
Kenneth E. Beal

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## INTRODUCTION

*Scope of Coverage:* After more than twenty years of experience in working with aquatic vascular plants, I am ready to accept the concept that there are no such things--at least not in terms of the living cells of those plants being aquatic. Rather it is evident that atmospheric vascular plants have returned to the aquatic habitat and can survive, even when totally submersed, through the fortuitous development of an extensive internal atmosphere provided by aerenchyma. Gas exchange is thus not restricted to the plant surface/water interface but greatly enhanced (in all except, possibly, *Podostemum*) by the extensive cell surface/internal atmosphere interface. The extensive nature of aerenchyma in many marsh and aquatic species is well illustrated by Ogden (1974b) and discussed by Sculthorpe (1967).

Extensive internal atmospheres are, however, highly subject to flooding as an inevitable result of damage by insects, wave action or other agents. Consequently, the ability to prevent, or at least limit, flooding of the aerenchyma following injury is also essential to survival in the aquatic environment. Various anti-flooding mechanisms, such as partial or complete partitions, sclerids, etc. have been developed by various species. Insight into the nature of these anti-flooding devices is provided by Sculthorpe (1967) and Kaul (1971, 1972, 1973, 1974).

I am also ready to conclude that there is no well-defined grouping of vascular plant species that can be called "aquatic," much less "marsh and aquatic." Rather, there is only a continuum in habitat from the terrestrial to the submersed with an associated shifting species composition. Muenscher (1944), in his Aquatic Plants of the United States, restricted his coverage to the more aquatic end of that continuum whereas Fassett (1940), in his Manual of Aquatic Plants, included species toward the more terrestrial end as well.

My own studies initially were restricted to those species toward the more aquatic portion of the spectrum. As a result, my field work in North Carolina has been limited primarily to the concept of "aquatic" as exemplified by Muenscher (1944). In preparing this manuscript, however, it became increasingly more difficult to leave out species of less aquatic areas--partially because I "like" genera such as *Juncus* and *Eleocharis* and partially because most of the species of genera such as these are, at least, quasi-aquatic. The end result is that this manual includes numerous species that hardly can be called "aquatic" and that are not even necessarily limited to marshy areas.

If a definition of the marsh and aquatic group of species herein included is desired I can think of nothing better than 'those plants which a typical terrestrial taxonomist usually does not collect for fear of getting his feet wet.' Hopefully this concept of marsh and aquatic plants, although making more tenuous the decision as to which species toward the terrestrial end of the spectrum should be excluded, will make this manual more useful to those who work in wetlands as well as in strictly aquatic areas.

Despite the rather liberal concept of marsh and aquatic vascular plants discussed above, this manual does not attempt to include all

species found in mountain seeps, low pocossins, low savannahs, bogs, ditches, or swamps. Many species that grow in such habitats are included, to be sure, but numerous other species have been excluded on a purely subjective basis.

*Keys:* Two basic keys are provided. The GENERAL KEY, starting on page 7, is designed to lead to all marsh and aquatic families and/or genera known to exist in North Carolina. This key refers to the appropriate family or genus, by page number, where subsequent species keys are presented in the text. The RESTRICTED KEY TO PLANTS OF BRACKISH WATER, SALT MARSHES, AND MARINE AREAS, starting on page 24, is designed as a self-contained key to all species known to exist in those areas of North Carolina. As such, its utilization for plants known to occur in those habitats should be more convenient than the general key. The restricted key refers to the appropriate species in the text by page number.

*Organization of Text:* The arrangement of families within the text follows that presented in the Manual of the Vascular Flora of the Carolinas (Radford *et al.*, 1964). The arrangements of genera within families and species within genera follow the order in which those taxa appear in the family and generic keys. They are not alphabetical but are numbered consecutively. Illustrations are presented in the same relative order.

Within each species presentation are general comments on distribution in North Carolina and in the contiguous United States. Distribution maps for North Carolina are not presented since they are already available in the Manual of the Vascular Flora of the Carolinas. Comments on the apparent accuracy of current taxonomic treatments are also made, as deemed appropriate, on the basis of personal experience.

*Habitat data:* A summary of habitat data, in terms of pH, Chloride content, Organic Matter content and Specific Conductance of the water, is presented, by bar graphs, for each species where original data are available. The bar graphs are intentionally much reduced in size, in the interest of space, but the scales may be read easily with the use of a hand lens. The scales are as presented in Fig. 1.

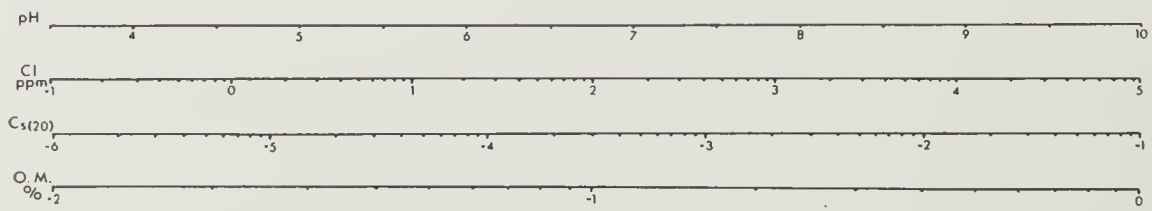


Figure 1. Scales used in presenting habitat data in the text. Specific Conductivity is in terms of mhos/centimeter.

Field work in North Carolina involved the collection of approximately seven thousand numbered plant specimens and the determination of pH, Chloride content, Organic Matter content, and Specific Conductivity of water samples from slightly less than three thousand locations throughout the State. Data for each species are summarized on the bar graphs as follows: one to four observations are individually marked. Five to twelve observations are represented by a total range bar immediately above the scale and the median is indicated by a mark above the bar. More than twelve observations are indicated by a total bar immediately above the scale, a second bar that represents the median two-thirds of the observations and a median which is indicated by a mark above the second bar.

All pH measurements were made in the field either with a portable electric pH meter or colorimetrically. Chloride and Organic Matter determinations were made by the Soil Testing Division of the North Carolina Department of Agriculture using techniques adapted to water analysis. Specific conductivity measurements were made originally in terms of Measured Resistance (ohms) at 30°C and subsequently converted

to  $C_s(20)$  according to the formula  $C_s(20) = \frac{0.0817}{R_m(30)}$ .

When plotted on a state-wide geographical basis the habitat data discussed above provide an interesting view of aquatic areas (still and flowing combined) of the State (Figures 2 and 3). Since numerous species have been found to exhibit very specific, and often restrictive, patterns of pH, Chloride, Organic Matter, and/or Specific Conductance requirements it is presumed that these environmental conditions (either individually or in combination), along with other conditions not analyzed, are highly critical in determining the distribution of many marsh and aquatic species.

Numerous river drainage systems are evident in North Carolina. (Figure 4). However, the distributions of few, if any, marsh and aquatic species seem to be correlated with drainage systems.

*Acknowledgements:* Most grateful words of appreciation are due to many individuals and organizations involved in the preparation of this manual. Not everyone can be mentioned but the following are especially deserving of recognition.

The North Carolina Department of Agriculture, Soil Testing Division, most graciously provided Chloride and Organic Matter analyses of all water samples collected throughout the State.

The herbaria of Duke University, the University of North Carolina at Chapel Hill, and North Carolina State University were graciously made available by their curators.

Mrs. Sara F. Brown has provided remarkably artistic, yet accurate, illustrations and is much deserving of the warmest appreciation. The illustrations of *Sparganium* and the habit sketch of *Sagittaria fasciculata* were provided by Tom Olive for which he deserves much thanks.



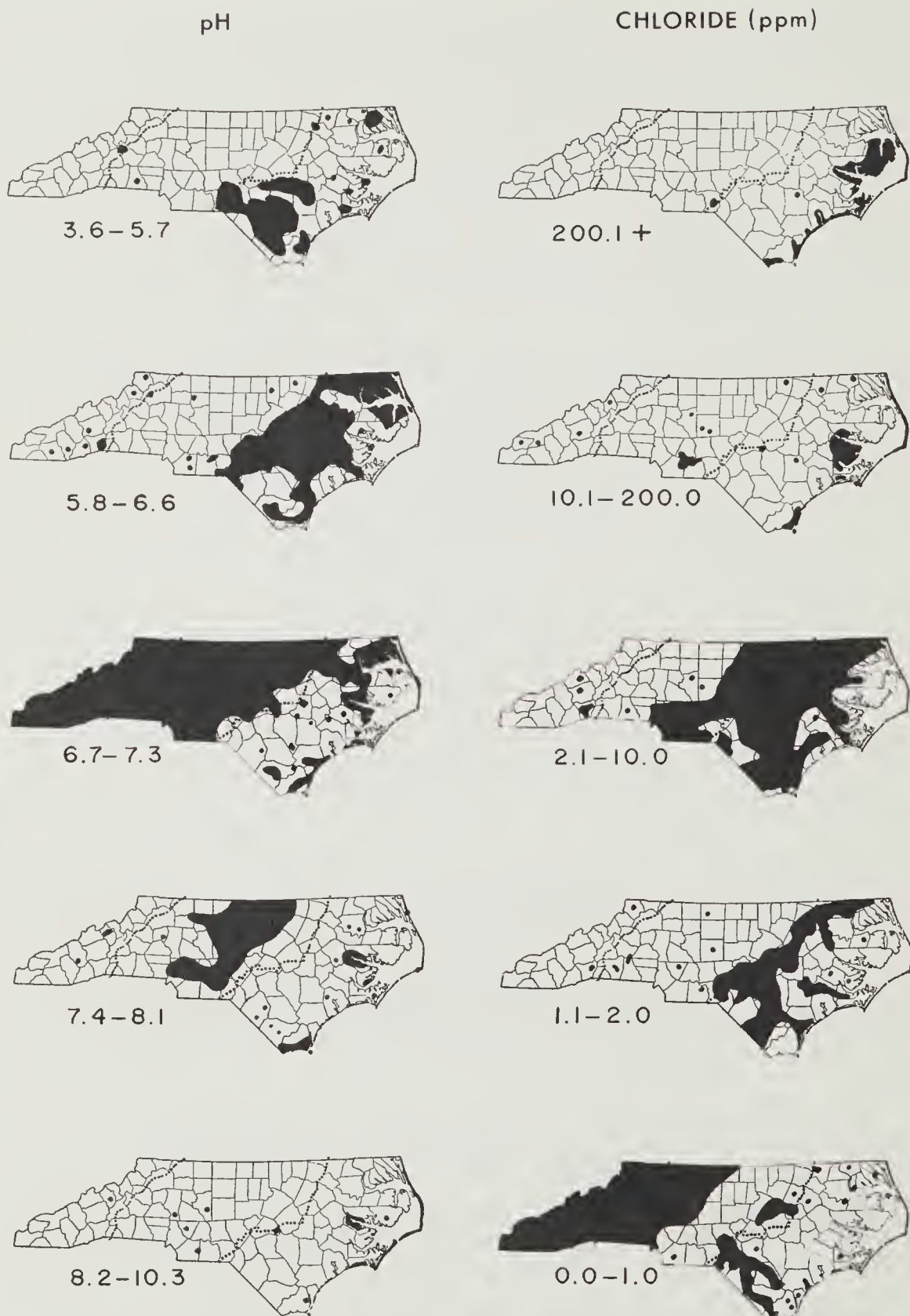


Figure 2. The pH and chloride content (ppm) of still and flowing surface waters in North Carolina.

ORGANIC MATTER (%)

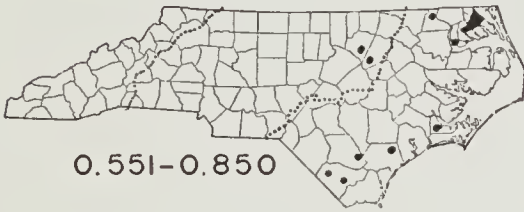
$C_{S(20)}$  mhos / centimeter



0.851 +



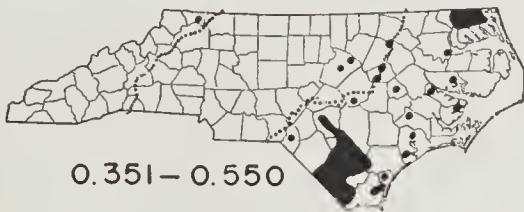
$8.25 \times 10^{-3}$  or higher



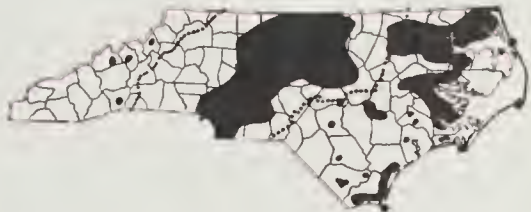
0.551-0.850



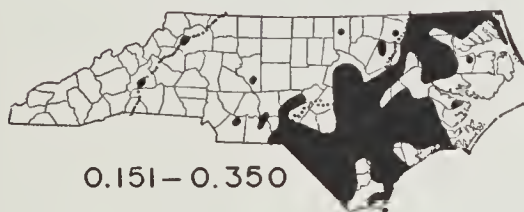
$8.24 \times 10^{-3} - 9.08 \times 10^{-4}$



0.351-0.550



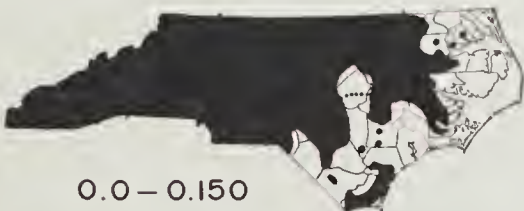
$9.07 \times 10^{-4} - 8.60 \times 10^{-5}$



0.151-0.350



$8.59 \times 10^{-5} - 2.33 \times 10^{-5}$



0.0-0.150



$2.32 \times 10^{-5}$  or less

Figure 3. The organic matter content and specific conductance of still and flowing surface waters in North Carolina.

Several individuals assisted in taxonomic analyses and in the preparation of keys for various taxa while students at North Carolina State University and deserve a special note of appreciation. They are, in alphabetical order, Charles Adair, Sara F. Brown, Dale Harrison, Edward Klekowski, Gloria S. Lowe, Bill Spooner, and Jerry Stone.

The data presented in this manual could never have made the transition from raw data to typed page without secretarial assistance. Thus, special appreciation is extended to Dolly Watson, Diane Black, and Jackie Everhard for providing expert skills in this regard. John W. Thieret most graciously provided assistance in reviewing the manuscript.

Finally, most grateful thanks are due the North Carolina Agricultural Experiment Station for providing both financial and moral support for this project.



Figure 4. Drainage systems and physiographic provinces of North Carolina.



## GENERAL KEY

(For restricted key to plants of brackish water, salt marshes, and marine areas see page 24.)

- A. Plant woody.....Group A (p. 7)
- A. Plant not woody.
  - B. Plant a vine or vine-like and climbing.....Group B (p. 8)
  - B. Plant not climbing.
    - C. Leaves absent, reduced to bladeless basal sheaths, reduced to bladders, reduced to scales less than 5 mm long *or* fused with the stem into free-floating fronds less than 10 mm long.....Group C (p. 9)
    - C. Leaves present and not reduced as above.
      - D. Plants *either* with basal leaves *or* plants supported by the water, free-floating or rooted.
        - E. Leaves compound or at least deeply dissected (simple leaves may also be present); plants supported by the water.....Group D (p. 10)
        - E. Leaves simple; plants supported by the water.
          - F. Leaves *either* 6 mm or less wide *or, if wider,* linear-elongate, narrowly lanceolate or terete.
            - G. Leaves basal [excluding the involucre bract(s)].....Group E (p. 11)
            - G. Leaves borne along the stem.....Group F (p. 12)
          - F. Leaves with expanded lamina more than 6 mm wide.
            - H. Leaves basal [excluding the involucre bract(s)].....Group G (p. 15)
            - H. Leaves borne along the stem.....Group H (p. 17)
      - D. Plants with leafy stems not supported by the water, either creeping, ascending or erect.
        - I. Leaves compound or deeply dissected.....Group I (p. 19)
        - I. Leaves simple and not deeply dissected.
          - J. Leaves, at least the upper, alternate.
            - K. Plant a monocot.....Group J (p. 19)
            - K. Plant a dicot.....Group K (p. 20)
          - J. Leaves opposite or whorled.....Group L (p. 22)

## GROUP A

### *WOODY PLANTS*

- A. Plant with alternate leaves.
  - B. Leaves compound, with 5-9 leaflets; stems with prickles.....*Rosa* (p. 193)
  - B. Leaves simple.
    - C. Inflorescence composed of solitary bisexual flowers scattered along the stem.....*Suaeda* (p. 176)
    - C. Inflorescence composed of unisexual cones, heads or spike-like catkins.
      - D. Inflorescence composed of involucre heads.
        - E. Leaves petiolate, coarsely few-toothed above the middle; stem without spreading hairs; heads without ray flowers.....*Baccharis* (p. 268)

- E. Leaves sessile, entire; stem pubescent; heads with numerous pink to purplish ray flowers.....*Aster* (p. 269)
- D. Inflorescence composed of cones or spike-like catkins.
  - F. Female inflorescence woody.
    - G. Leaves needle-like or narrowly flat-linear, entire; female cone globose, scales peltate.....*Taxodium* (p. 32)
    - G. Leaves ovate to oblong, sharply serrate; female catkin oblong-ellipsoid to ovoid, scales not peltate.....*Alnus* (p. 166)
  - F. Female inflorescence not woody.
    - H. Leaves regularly serrate throughout, not resinous; fruit silky-pubescent, ovoid.....*Salix* (p. 166)
    - H. Leaves entire or with a few coarse serrations on the upper half of the blade, heavily golden dotted on both surfaces; fruit globose with a white waxy coating.....*Myrica* (p. 166)
- A. Plant with opposite and/or whorled leaves.
  - I. Flowers and fruits in dense heads.
    - J. Heads not subtended by involucre bracts; leaves opposite and/or whorled; plant of freshwater areas.....*Cephalanthus* (p. 263)
    - J. Heads subtended by numerous imbricated bracts; leaves opposite; plant of brackish marshes.
      - K. Leaf tip sharply mucronate, margin entire to spiny-serrate, blade widest above the middle; heads erect.....*Borrighia* (p. 274)
      - K. Leaf tip acute but not mucronate, margin serrate, blade widest at or below the middle; heads pendant.....*Iva* (p. 274)
  - I. Flowers and fruits not in dense heads.
    - L. Leaves with broadened blades, lanceolate, elliptic or ovate-lanceolate, up to 20 cm long.
      - M. Flowers in axillary clusters.....*Decodon* (p. 203)
      - M. Flowers in terminal clusters.....*Cornus* (p. 229)
    - L. Leaves less than 2 cm long, narrowly linear or reduced to scales.
      - N. Plant succulent; leaves reduced to scales; flowers in 3's, imbedded in the fleshy stem; plant of salt marshes and salt flats.....*Salicornia* (p. 174)
      - N. Plant not succulent; leaves narrowly linear; flowers not imbedded in the stem; plant of freshwater areas.....*Hypericum* (p. 200)

## GROUP B

### VINES or VINE-LIKE CLIMBING PLANTS

- A. Leaves reduced to minute scales no more than 3 mm long..
  - .....*Bartonia* (p. 234)
- A. Leaves more than 5 mm long, simple or compound.
  - B. Leaves alternate.
    - C. Leaves simple.....*Polygonum* (p. 169)

- C. Leaves compound.
  - D. Leaves with numerous filiform segments.....*Ptilimmium* (p. 226)
  - D. Leaves 2-3 times divided with broad ultimate leaf-lets (*Ampelopsis arborea*, which often occurs on the margins of marshes but is not herein included).
- B. Leaves opposite or whorled.
  - E. Leaves petiolate, opposite.....*Mikania* (p. 274)
  - E. Leaves sessile, at least some whorled.....*Galium* (p. 263)

#### GROUP C

Plants *either* with LEAVES ABSENT, REDUCED TO BLADELESS BASAL SHEATHS, REDUCED TO BLADDERS, REDUCED TO SCALES less than 5 mm long *or* fused with the stem into FREE-FLOATING FRONDS less than 10 mm long

- A. Plant thallose, without a clearly defined stem.
  - B. Body of plant branching dichotomously.
    - C. Plant firmly attached to rocks in streams and rivers; roots not produced.....*Podostemum* (p. 191)
    - C. Plant free-floating or stranded on shore; roots present (the following two species are liverworts and are not included in this manual).
      - D. Divisions of the plant body numerous and narrowly linear; usually floating below surface (*Riccia fluitans*).
      - D. Divisions of the plant body few and broad; floating on the surface (*Ricciocarpus natans*).
  - B. Body of plant not branching dichotomously; stem and leaf fused into a free-floating frond less than 10 mm long; each frond producing new fronds from 1 or 2 pockets--thus, fronds may exist in clusters...LEMNACEAE (p. 140)
- A. Plant with a definite elongate stem.
  - E. Stem with whorled branches (*Chara* and *Nitella*, both algae and not included in this manual).
  - E. Stem without whorled branches.
    - F. Plant submersed and/or free-floating with stems supported by the water.
      - G. Plant free-floating on the water surface, about 1 cm wide, often forming green to rusty-red mats; leaves in two ranks, bilobed; the upper lobes less than 1 mm in diameter, on the water surface; the lower lobes submersed, some bearing globular sporocarps which contain either mega- or microsporangia.....*Azolla* (p. 32)
    - G. Plant floating below the water surface (inflorescence may be emersed).
      - H. Stem bearing alternate leaves.
        - I. Petioles about 1 mm long, each terminating in a minute bladder.....*Utricularia* (p. 255)
        - I. Petioles absent; leaves sessile, linear-lanceolate, abundantly scattered along the stem, moss-like, 1-nerved; flowers axillary, solitary, with 3 sepals and 3 petals.....*Mayaca* (p. 142)
      - H. Stem proliferating extensively; leaves reduced to basal sheaths.....*Eleocharis* (p. 102)

- F. Plant submersed or emersed, rooted, with erect self-supporting stems.
- J. Leaves reduced to basal sheaths.
  - K. Flowers with sepals and petals, in an umbellate cluster which is apparently lateral but is actually terminal, the involucral bract erect and appearing to continue the culm.....*Juncus* (p. 152)
  - K. Flowers without sepals and petals, imbricated in one or more spikelets.
    - L. Spikelets appearing lateral but actually terminal, the involucral bract appearing to continue the culm.....*Scirpus* (p. 123)
    - L. Spikelet solitary, terminal, without an involucral bract.....*Eleocharis* (p. 102)
- J. Leaves reduced to cauline scales less than 5 mm long.
  - M. Leaves all opposite; stem thick and fleshy; flowers in 3's, imbedded in the fleshy stem; plant of salt marshes.....*Salicornia* (p. 174)
  - M. Leaves all alternate (or at most a few opposite); stem not fleshy; plants of freshwater areas.
    - N. Corolla strongly bilateral.....*Utricularia* (p. 255)
    - N. Corolla not bilateral.
      - O. Plant wiry, with a few scale-like leaves; flowers in a terminal raceme or panicle..
        - .....*Bartonia* (p. 234)
      - O. Plant moss-like, with abundant, alternate, 1-nerved leaves; flowers axillary with 3 sepals and 3 petals.....*Mayaca* (p. 142)

#### GROUP D

Plants *SUPPORTED BY THE WATER*, free-floating or rooted, *WITH COMPOUND* or at least *DEEPLY DISSECTED LEAVES* (some simple leaves may also be present)

- A. Leaves bearing bladders.....*Utricularia* (p. 255)
- A. Leaves not bearing bladders.
  - B. Leaf trifoliolate, pinnate or repeatedly pinnately dissected.
    - C. Leaf divisions broad, expanded.
      - D. Leaves clustered toward the stem base, trifoliolate..
        - .....*Menyanthes* (p. 235)
      - D. Leaves scattered along an elongate stem, pinnate.....BRASSICACEAE (p. 188)
    - C. Leaf divisions narrowly linear to filiform.
      - E. Leaf repeatedly pinnately dissected.....*Armoracia* (p. 188)
      - E. Leaf once pinnate.
        - F. Flowers borne on a floating racemose inflorescence with several spongy-inflated branches.....*Hottonia* (p. 229)
        - F. Flowers borne on the unbranched, noninflated main axis of the stem.....HALORAGACEAE (p. 219)
  - B. Leaf once to several times dichotomously or palmately dissected (usually more than once dissected).
    - G. Plant firmly attached to rocks in streams or rivers; roots absent.....*Podostemum* (p. 191)



- G. Plant rooted in the substrate or free-floating.
  - H. Submersed leaves alternate.....*Ranunculus* (p. 183)
  - H. Submersed leaves opposite or whorled.
    - I. Submersed leaves whorled, their divisions often filiform with minute serrations; floating leaves never produced.....*Ceratophyllum* (p. 177)
    - I. Submersed leaves opposite, lax, without serrations; floating leaves, when present, alternate and peltate.....*Cabomba* (p. 183)

#### GROUP E

Plants *either SUPPORTED BY THE WATER or with BASAL LEAVES LESS THAN 6 mm WIDE*, if wider, *LINEAR-ELONGATE, NARROWLY LANCEOLATE OR TERETE*

- A. Bases of leaves spoon-shaped, bearing either micro- or megasporangia; stem limited to a short corm bearing a tuft of linear-subulate leaves.....*Isoetes* (p. 31)
- A. Bases of leaves not bearing sporangia.
  - B. Leaves and flowering stem lax, wholly supported by the water.
    - C. Plant of marine waters.
      - D. Leaf with 3 nerves, tip with 3 points.....*Halodule* (p. 39)
      - D. Leaf with 5 or more nerves.
        - E. Tip of leaf with entire, rounded shoulders and a minute apical point.....*Zostera* (p. 39)
        - E. Tip of leaf with minute serrations.....*Thalassia* (p. 72)
    - C. Plant of non-marine waters.
      - F. Leaf with a broad central band of lacunae, margin with minute teeth especially toward the tip..
        - .....*Vallisneria* (p. 70)
      - F. Leaf without a differentiated central band, margin without minute teeth.
        - G. Flowers in one to many spikelets subtended by a solitary, linear bract.....*Scirpus* (p. 123)
        - G. Flowers solitary in globose heads with a bract below each head or racemose in whorls of 3 with a bract below each flower.
          - H. Flowers solitary, with greenish-yellow (sometimes with maroon or rusty-red markings) conspicuous sepals; base of leaf with broadly rounded lobes..
            - .....*Nuphar* (p. 179)
          - H. Flowers in globose heads or racemose, sepals not conspicuous.
            - I. Areolate structure of leaf regular; leaves all strictly narrowly linear, faintly to strongly keeled on the back; flowers in globose heads, juice not milky.....*Sparganium* (p. 37)
            - I. Areolate structure of leaf irregular; leaves subulate, lanceolate, spatulate or linear, not keeled; flowers in whorls of 3; juice milky...
              - .....*Sagittaria* (p. 60)
    - B. Leaves and flowering stem self-supporting.
      - J. Flowers compacted in heads, spikes or spikelets.

- K. Involucral bract erect, appearing to continue the culm, the inflorescence appearing lateral; base of stem and rhizomes producing a strong, sweet odor..  
.....*Acorus* (p. 136)
- K. Involucral bract(s), if present, not appearing to continue the culm.
  - L. Leaves net-veined; involucral bracts tridentate..  
.....*Eryngium* (p. 226)
  - L. Leaves parallel-veined; involucral bract(s), if present, not tridentate.
  - M. Heads or spikes of two types, the upper male, the lower female.
    - N. Flowers in elongated, dense, spike-like panicles on a single axis.....*Typha* (p. 32)
    - N. Flowers in globose heads usually borne on a branched inflorescence.....*Sparganium* (p. 37)
  - M. Head(s) or spike(lets) uniform, of one type.
    - O. Inflorescence consisting of a single terminal head or spike(let).
      - P. Inflorescence a head of inconspicuous flowers, subtended by numerous chaffy bracts.....  
.....ERIOCAULACEAE (p. 145)
      - P. Inflorescence a spike with each scale fertile; flowers conspicuous, yellow; involucral bracts absent.....*Xyris* (p. 144)
    - O. Inflorescence consisting of several heads or spikelets.
      - Q. Flowers in spikelets with spirally imbricated scales; sepals and petals absent...CYPERACEAE (p. 92)
      - Q. Flowers in few-flowered heads; each flower with 3 sepals and 3 petals.....JUNCACEAE (p. 152)
- J. Flower(s) solitary or loosely arranged in an umbel, raceme or panicle, not in compacted heads, spikes or spikelets.
- R. Basal leaves broadened, broadest toward the tip.
  - S. Leaves pubescent, at least on top.
    - T. Surface of upper side of leaf blade with non-glandular hairs; axis of inflorescence not coiled.....*Lobelia* (p. 266)
    - T. Surface of leaf blade covered with long-stalked sticky-glandular hairs; inflorescence racemose, the flowers arranged toward one side of the main axis which uncoils as a new flower opens each day.....*Drosera* (p. 193)
  - S. Surface of leaf glabrous.
    - U. Leaf hollow, subterete, and septate; flowers in an umbel.....*Lilaeopsis* (p. 222)
    - U. Leaf not hollow, not septate; flowers in whorls of 3.....*Sagittaria* (p. 60)
- R. Basal leaves without broadened tips.
  - V. Leaves broadly linear, at least 8 mm wide.
    - W. Flower with a conspicuous membranous staminal tube, white.....*Hymenocallis* (p. 162)
    - W. Flower without a staminal tube, yellow, blue, purple or rarely white.....*Iris* (p. 162)
  - V. Leaves narrowly linear, less than 8 mm wide.
    - X. Flowering culms bearing bracts which are similar to the leaves.

- Y. Involucral bract solitary, erect and appearing to continue the culm; flowers inconspicuous..  
.....*Juncus* (p. 152)
- Y. Involucral bract(s) present at the base of each inflorescence branch, not culm-like; flowers conspicuous.....*Iris* (p. 162)
- X. Flowering culm without foliaceous bracts.
  - Z. Inflorescence a solitary flower or a simple umbel.
    - a. Flower solitary; leaves subulate, tufted from a slender rhizome.....*Limosella* (p. 249)
    - a. Flowers in an umbel; leaves subterete, hollow, with cross-partitions, arising from the nodes of a slender rhizome...  
.....*Lilaeopsis* (p. 222)
  - Z. Inflorescence a raceme.
    - b. Flowers in whorls of 3; petals conspicuous..  
.....*Sagittaria* (p. 60)
    - b. Flowers scattered along the raceme axis; petals absent.....*Triglochin* (p. 55)

#### GROUP F

Plants *SUPPORTED BY THE WATER* with *SIMPLE CAULINE LEAVES LESS THAN 6 mm WIDE* or, if wider, *LINEAR-ELONGATE, NARROWLY LANCEOLATE OR TERETE*

- A. Leaves opposite or whorled.
  - B. Leaves whorled.
    - C. Margin of leaf serrulate; flowers unisexual, borne from spathes in the leaf axils.....*HYDROCHARITACEAE* (p. 69)
    - C. Margin of leaf entire; flowers bisexual, borne in a terminal head(s).....*Sclerolepis* (p. 274)
  - B. Leaves opposite.
    - D. Plants with leaves of different shapes, from linear to broadly spatulate.
      - E. Tip of linear leaves deeply indented with two cusp-like lateral points, blade wing-margined to the base; upper leaves spatulate, floating on the water surface; fruit obcordate, flattened.....*Callitriche* (p. 195)
      - E. Tip of linear leaves blunt to shallowly and bluntly indented, blade narrowed to the base; upper leaves not floating on the water surface; fruit subglobose with a thin and transparent pericarp; seeds visible, coarsely areolate.....*Elatine* (p. 200)
    - D. Plants with all leaves of the same general shape.
      - F. Blades serrate or with spinulose teeth.
        - G. Leaf 5 mm or more wide, firm, narrowly elliptic to lanceolate with sharp serrations from about the middle to the tip, base narrowed and without serrations; flowers borne in a long-stalked axillary spike.....*Lippa* (p. 242)

- G. Leaf less than 2 mm wide, delicate, linear, with sharp spinulose teeth extending to the flared base; flowers sessile in the leaf axils; fruit with a thin pericarp, 1-seeded; seed surface reticulate-areolate.....*Najas* (p. 53)
- F. Blades with entire margins.
  - H. Leaf linear-filiform, narrowing to an acute sharply pointed tip; fruit axillary, curved-cylindric, terminally beaked, and often dentate on the back...  
.....*Zannichellia* (p. 53)
  - H. Leaf linear to broadly rounded with a blunt to indented tip, never with one sharp point.
    - I. Leaf ovate, broadly rounded or obovate, at least 3 mm wide.....*SCROPHULARIACEAE* (p. 247)
    - I. Leaf linear, lanceolate, oblanceolate or spatulate, less than 3 mm wide.
      - J. Tip of leaf deeply indented with two cusp-like lateral points; fruit obcordate, flattened...  
.....*Callitriche* (p. 195)
      - J. Tip of leaf rounded to bluntly indented.
        - K. Leaf lanceolate to oblanceolate, mostly 3-nerved, the base wing-margined; fruit axillary, globose, green.....*Peplis* (p. 202)
        - K. Leaf lanceolate to spatulate, 1-nerved, the base not wing-margined where attached to the stem; fruit axillary, subglobose, with thin and transparent pericarp, the seeds visible; seeds coarsely areolate...  
.....*Elatine* (p. 200)
- A. Leaves alternate.
  - L. Blade of floating leaves peltate; submersed leaves opposite and deeply dissected.....*Cabomba* (p. 183)
  - L. Blade not peltate.
    - M. Plant free-floating on the water surface; about 1 cm wide, often forming green to rusty-red mats; leaves in two ranks, bilobed; the upper lobes at water surface, less than 1 mm in diameter, the lower lobes submersed, some bearing globular sporocarps containing either mega- or microsporangia.....*Azolla* (p. 32)
    - M. Plant not free-floating on the water surface.
      - N. Leaves less than 10 mm long, linear-lanceolate, abundantly scattered along the stem, moss-like, 1-nerved; flowers axillary, with 3 sepals and 3 petals.....*Mayaca* (p. 142)
      - N. Leaves more than 10 mm long.
        - O. Blade of leaf with long-stalked sticky-glandular hairs, spatulate; flowers on one side of a racemose inflorescence which uncoils as a new flower opens each day.....*Drosera* (p. 193)
        - O. Blade of leaf not glandular-hairy.
          - P. Plant rigidly erect; leaves very firm; flowers in umbellate heads subtended by tridentate bracts..  
.....*Eryngium* (p. 226)
          - P. Plant lax or prostrate; leaves soft or limp; flowers not in umbellate heads.



- Q. Leaves and stem floating on the water surface or emersed (unless in inundated area), not totally submersed.
  - R. Basal leaves cordate, upper leaves becoming narrowly linear, without sheathing leaf bases; petals yellow, with a gland toward the base of each petal.....*Ranunculus* (p. 183)
  - R. Basal and upper leaves similar, with sheathing bases.
    - S. Flowers conspicuous, 3-merous, petals pink; leaf sheath closed.....*Aneilema* (p. 147)
    - S. Flowers inconspicuous, in spikelets; petals absent; leaf sheath open (except in *Glyceria*).....POACEAE (p. 72)
- Q. Leaves and stem totally submersed (except for flowering portion which may be emersed).
  - T. Leaves arising toward the base of the stem, not evenly scattered; inflorescence a spikelet(s) subtended by an involucre bract(s).....*Scirpus* (p. 123)
  - T. Leaves scattered along the stem.
    - U. Stipule present and not fused to the leaf base.....*Potamogeton* (p. 39)
    - U. Stipule fused to leaf base.
      - V. Leaf septate.....*Potamogeton* (p. 39)
      - V. Leaf not septate.
        - W. Blade of leaf flat, narrowly linear to setaceous, with a midrib; flowers without sepals and petals; fruits becoming long-stalked at maturity..  
.....*Ruppia* (p. 53)
        - W. Blade of leaf linear but thickened, narrowly elliptic in cross-section, without a midrib but with several equal nerves; flowers with pale yellow petals.....*Heteranthera* (p. 149)

#### GROUP G

Plants *either SUPPORTED BY THE WATER or with BASAL LEAVES BEARING EXPANDED LAMINA MORE THAN 6 mm WIDE*

- A. Blade of leaf peltate.
  - B. Leaf blade 1 dm or less in diameter; flowers in umbels.....*Hydrocotyle* (p. 224)
  - B. Leaf blade much more than 1 dm in diameter; flowers solitary, very conspicuous, yellow or pink.....*Nelumbo* (p. 181)
- A. Blade of leaf not peltate.
  - C. Plant free-floating (may be stranded on shore but not rooted).
    - D. Leaf blade green on both surfaces, base broadly cuneate, petiole usually inflated; flowers bisexual, conspicuous, blue.....*Eichhornia* (p. 149)

- D. Leaf blade usually purplish and spongy on the lower surface, base with broadly rounded lobes to nearly truncate, petiole not inflated; flowers unisexual, inconspicuous.....*Limnobium* (p. 70)
- C. Plant rooted in the substrate.
  - E. Leaf base truncate to deeply lobed.
  - F. Leaves floating on the water surface.
    - G. Peduncle fused with the petiole, the combined structure petiole-like, producing a cluster of flowers (and later a fascicle of tubers) a few cm below the leaf blade; flowers with 5 sepals, 5 petals and 5 stamens.....*Nymphoides* (p. 234)
    - G. Peduncle not fused to the petiole.
      - H. Flowers solitary, arising with the leaves from the tip portion of a fleshy rhizome; ovary superior; stamens numerous, grading into the petals.....NYMPHAEACEAE (p. 179)
      - H. Flowers in umbels, arising with the leaves along a slender elongate rhizome; ovary inferior; sepals and petals, five in number; stamens distinct.....*Hydrocotyle* (p. 224)
  - F. Leaves emersed.
    - I. Flowers borne on a fleshy spadix enclosed in a fleshy spathe.....ARACEAE (p. 136)
    - I. Flowers not borne on a fleshy spadix.
      - J. Major lateral veins arising from a midrib.
        - K. Flowers zygomorphic, white.....*Viola* (p. 202)
        - K. Flowers regular, the sepals greenish to yellow and sometimes with maroon or rusty-red markings.....*Nuphar* (p. 179)
      - J. Major lateral veins arising from the junction of the blade with the petiole.
        - L. Leaves without reticulate venation, all veins arising from the base and extending to the apex of the cordate blade; flowers blue (rarely white), in a conspicuous spike subtended by a leafy bract.....*Pontederia* (p. 149)
        - L. Leaves with reticulate venation.
          - M. Reticulation essentially rectangular, the minor veins more or less perpendicular to the major lateral veins; plant a monocot.
            - N. Inflorescence a raceme of flowers in whorls of 3 or a panicle with whorled branches; leaves neither spongy nor purplish below...  
.....ALISMATACEAE (p. 57)
            - N. Inflorescence a solitary flower or 2-3 from a leafy spathe; leaves usually spongy and purplish below.....*Limnobium* (p. 70)
          - M. Reticulation irregular (net veined), the minor lateral veins not perpendicular to the major lateral veins; plant a dicot.
            - O. Flowers solitary.....*Nymphaea* (p. 179)
            - O. Flowers in a spike or umbel.
              - P. Inflorescence a spike; ovary superior..  
.....*Plantago* (p. 263)

- P. Inflorescence an umbel; ovary inferior..  
.....APIACEAE (p. 222)
- E. Leaf base broadly cuneate to narrow, without basal lobes.
  - Q. Plant either with leaves hollow or covered with long-stalked sticky glands; carnivorous.
    - R. Leaves hollow, filled with moisture and decayed insects at the base.....*Sarracenia* (p. 191)
    - R. Leaves not hollow but covered with long-stalked sticky-glandular hairs.....*Drosera* (p. 193)
  - Q. Plant with foliaceous leaves; not carnivorous.
    - S. Leaf blade with parallel veins running from base to apex, without reticulation; flowers borne on an elongated golden-yellow spadix.....*Orontium* (p. 138)
    - S. Leaf blade with reticulate venation between the major veins.
      - T. Blade of leaf fleshy.
        - U. Tip of leaf mucronate; leaves mostly basal, the stem leaves greatly reduced and scale-like; inflorescence a diffuse panicle of individual flowers.....*Limonium* (p. 231)
        - U. Tip of leaf not mucronate; stem leaves numerous, foliaceous but reduced in size; flowers in involucrate heads.....*Solidago* (p. 268)
      - T. Blade of leaf not fleshy.
        - V. Flowers with 5 sepals and 5 petals, zygomorphic, solitary.....*Viola* (p. 202)
        - V. Flowers with 3 sepals and 3 petals, regular, borne in whorls of 3 on a raceme or panicle.....*Sagittaria* (p. 60)

#### GROUP H

Plants SUPPORTED BY THE WATER with SIMPLE CAULINE LEAVES  
BEARING EXPANDED LAMINA MORE THAN 6 mm WIDE

- A. Blade of leaf peltate.
  - B. Leaf blades much more than 1 dm in diameter.....*Nelumbo* (p. 181)
  - B. Leaf blades less than 1 dm in diameter.
    - C. Plants heavily coated with mucilage except for the upper leaf surface; flowers dull purple, solitary.....*Brasenia* (p. 183)
    - C. Plants not coated with mucilage; flowers white, in simple or compound umbels.....*Hydrocotyle* (p. 224)
- A. Blade of leaf not peltate.
  - D. Leaves opposite.
    - E. Flowers in dense heads or spikes.
      - F. Inflorescence a head.....*Lippia* (p. 242)
      - F. Inflorescence a spike.....*Alternanthera* (p. 176)
    - E. Flowers not in heads or spikes.
      - G. Sepals 4.
        - H. Leaves suborbicular, 7 mm or less in length, broadly rounded at the apex; ovary superior..  
.....*Micranthemum* (p. 249)

- H. Leaves elliptic to oblanceolate, obovate or spatulate, more than 8 mm long, usually with an obtuse or acute apex; ovary inferior.....*Ludwigia* (p. 210)
- G. Sepals 5.
  - I. Plant succulent; sepals of two shapes, the larger ovate, the smaller linear; petals white or blue, not deeply bilobed.....*Bacopa* (p. 249)
  - I. Plant not succulent; sepals uniform; petals white, deeply bilobed.....*Stellaria* (p. 177)
- D. Leaves alternate.
  - J. Veins of leaf blade extending from the base to the apex; plant a monocot.
    - K. Leaf blade cordate to reniform, usually wider than long, petiolate; flowers white to blue, few-to-several borne from a spathe.....*Heteranthera* (p. 149)
    - K. Leaf blade cordate to linear-lanceolate, longer than wide, sessile to petiolate; flowers without petals and not borne from a spathe.
      - L. Plant a submersed aquatic, often with both submersed and floating leaves; flowers borne in whorls on terminal or axillary spikes, each flower with 4 stamens and producing 4 nutlets..  
.....*Potamogeton* (p. 39)
      - L. Plant emergent or floating (unless in inundated area), with all leaves similar; flowers subtended by a palea and lemma, in spikelets usually subtended by two glumes; stamens 3; nutlet solitary..  
.....POACEAE (p. 72)
  - J. Veins of leaf blade arising from the midrib as well as from the base; plant a dicot.
    - M. Leaf base strongly lobed.
      - N. Blade of leaf suborbicular, no more than 5 cm wide; flowers umbellate, inconspicuous, with 5 sepals and 5 petals.....*Hydrocotyle* (p. 224)
      - N. Blade of leaf suborbicular to cordate-elongate, usually much more than 5 cm wide; flowers solitary, conspicuous, with more than 5 stamens and carpels.....NYMPHAEACEAE (p. 179)
    - M. Leaf base barely, if at all, lobed.
      - O. Petals yellow, each bearing a gland toward the base; each flower producing numerous achenes..  
.....*Ranunculus* (p. 183)
      - O. Petals absent or, if present, not yellow and not glandular; carpels fused into a compound ovary.
        - P. Ovary inferior.
          - Q. Petals absent, sepals 3; leaves, at least the lower, pectinate.....*Proserpinaca* (p. 221)
          - Q. Petals and sepals 5 or 6 in number; leaves entire.....*Ludwigia* (p. 210)
        - P. Ovary superior.
          - R. Petals absent; sepals 5; stipule sheathing the stem.....*Polygonum* (p. 169)
          - R. Petals and sepals 4 or 5 in number; stipules, if present, not sheathing the stem.

- S. Petals and sepals 4 in number; petals white; leaves occasionally with a pair of small lateral lobes.....*Cardamine* (p. 188)
- S. Petals and sepals 5 in number; petals blue; leaves never lobed.
- T. Stem armed with sharp spines; flowers uniformly blue; in axillary clusters..  
.....*Hydrolea* (p. 239)
- T. Stem unarmed; flowers blue with a yellow eye, in a terminal inflorescence with helicoid branches.....*Myosotis* (p. 239)

#### GROUP I

Plants with *COMPOUND LEAVES* (or at least deeply divided)  
*BORNE ALONG A STEM* that is *NOT SUPPORTED BY THE WATER*

- A. Inflorescence an involucrate head.
  - B. Involucral bracts tridentate; fruit not awned....*Eryngium* (p. 226)
  - B. Involucral bracts not tridentate; fruit awned.....*Bidens* (p. 274)
- A. Inflorescence not an involucrate head.
  - C. Flowers in simple or compound umbels.....*APIACEAE* (p. 222)
  - C. Flowers not in umbels.
    - D. Flowers sessile or subsessile, axillary; ovary inferior.....*HALORAGACEAE* (p. 219)
    - D. Flowers pedicellate; ovary superior.
      - E. Leaves with more than 5 leaflets, usually sensitive to light and also to the touch; flowers strongly zygomorphic.....*Aeschynomene* (p. 193)
      - E. Leaves with 5 or fewer divisions, not sensitive to light or touch; flowers regular.
        - F. Leaves clustered at the base of the stem, with 3 fleshy unlobed leaflets.....*Menyanthes* (p. 235)
        - F. Leaves scattered along an elongate stem; leaflets not fleshy, often lobed.
          - G. Petals yellow, with a gland toward the base, usually 5 in number; each flower producing numerous achenes.....*Ranunculus* (p. 183)
          - G. Petals white, glandless, 4 in number; carpels fused into a compound ovary.....*Cardamine* (p. 188)

#### GROUP J

*MONOCOTYLEDONOUS PLANTS* with *SIMPLE ALTERNATE LEAVES BORNE ALONG A STEM* that is *NOT SUPPORTED BY THE WATER*

- A. Leaf base neither clasping nor sheathing the stem; leaves numerous, 1-nerved, less than 1 cm long; plant moss-like.....*Mayaca* (p. 142)
- A. Leaf base clasping or sheathing the stem.



- B. Inflorescence simple or branched, bearing globose bur-like heads of pistillate flowers below and staminate flowers above.....*Sparganium* (p. 37)
- B. Inflorescence not composed of unisexual globose heads.
  - C. Perianth inconspicuous, composed of approximately equal scale-like sepals and petals, reduced to bristles or absent.
    - D. Leaf sheaths closed.
      - E. Leaves 2-ranked; stem terete with hollow internodes; flowers without perianth but subtended by a palea and lemma, in spikelets subtended by two glumes.. .....*Glyceria* (p. 77)
      - E. Leaves, if present, 3-ranked; stem usually sharply to obscurely triangular (terete or quadrangular in some species), usually not hollow; flowers often with perianth bristles or scales, not subtended by a palea and lemma, in spikelets not subtended by two glumes.....CYPERACEAE (p. 92)
    - D. Leaf sheaths open.
      - F. Flowers in spikelets; perianth absent; fruit a one-seeded nutlet.....POACEAE (p. 72)
      - F. Flowers not in spikelets; perianth scale-like, composed of 3 sepals and 3 petals; fruit a many-seeded capsule.....*Juncus* (p. 152)
  - C. Perianth with colored, herbaceous petals.
    - G. Leaf blades cordate to reniform; flowers blue.. .....PONTEDERIACEAE (p. 147)
    - G. Leaf blades without basal lobes, elliptic, lanceolate or linear.
      - H. Ovary inferior.
        - I. Leaf base sheathing and closed; flowers zygomorphic, racemose, greenish.....*Habenaria* (p. 165)
        - I. Leaf base clasping the stem, open; flowers regular, not racemose, yellow, blue, purple or white.....*Iris* (p. 162)
      - H. Ovary superior.
        - J. Leaf sheath ciliate; petals pinkish.....*Aneilema* (p. 147)
        - J. Leaf sheath glabrous; petals yellow..*Heteranthera* (p. 149)

#### GROUP K

*DICOTYLEDONOUS PLANTS with SIMPLE ALTERNATE LEAVES BORNE  
ALONG A STEM that is NOT SUPPORTED BY THE WATER*

- A. Flowers in umbels or involucrate heads.
  - B. Inflorescence a simple or compound umbel.....APIACEAE (p. 222)
  - B. Inflorescence composed of involucrate heads.
    - C. Involucral bracts tridentate.....*Eryngium* (p. 226)
    - C. Involucral bracts not tridentate.....ASTERACEAE (p. 268)
- A. Flowers variously arranged but neither umbellate nor in involucrate heads.
  - D. Corolla zygomorphic.

- E. Calyx 5-lobed; ovary inferior; flowers blue, violet,  
red or whitish.....*Lobelia* (p. 266)
- E. Calyx of 3 separate sepals or fused with 3 lobes;  
ovary superior; flowers yellow, orange or red (if  
red, heavily spotted).
- F. Middle sepal large, saccate and extending into a  
spur; petals 5; leaves broad, more or less uniform..  
.....*Impatiens* (p. 195)
- F. Middle sepal not bearing a spur; petals 3;  
leaves lanceolate to linear, less than 8 mm wide,  
mostly basal and becoming rapidly reduced  
above.....*Polygala* (p. 195)
- D. Corolla regular or absent.
- G. Ovary inferior or surrounded by a persistent  
staminal and perianth tube (hypanthium) and  
appearing to be inferior.
- H. Hypanthium fused into a persistent tube  
which surrounds (but is free from) the ovary;  
ovary actually superior.....*Lythrum* (p. 203)
- H. Hypanthium fused to the ovary; ovary truly  
inferior.
- I. Sepals 3.....*Proserpinaca* (p. 221)
- I. Sepals 4 or more.....ONAGRACEAE (p. 209)
- G. Ovary superior.
- J. Carpels 3 or more per flower, separate or nearly  
so.
- K. Perianth absent; inflorescence a long whitish  
raceme which usually droops at the tip.....*Saururus* (p. 165)
- K. Perianth present, composed of either sepals or  
sepals and petals.....RANUNCULACEAE (p. 183)
- J. Carpels fused at least one-half of their length  
into a single compound ovary.
- L. Stipule(s) fused into a tube surrounding the  
stem.....POLYGONACEAE (p. 168)
- L. Stipule(s), if present, not tubular.
- M. Stamens numerous, more than 2-times the number  
of sepals.
- N. Stamens united by their filaments into a tube..  
.....MALVACEAE (p. 198)
- N. Stamens not united into a tube.....NYMPHAEACEAE (p. 179)
- M. Stamens limited to no more than 2-times the  
number of sepals.
- O. Flowers sessile or short pedicellate on the  
side of curved to helicoid inflorescence branches.
- P. Leaves serrate; petals inconspicuous or  
absent.....*Penthorum* (p. 193)
- P. Leaves entire; petals present and obvious.
- Q. Leaves of two types, the basal with flattened  
blades, the cauline reduced to clasping  
scales; plant of brackish marshes..*Limonium* (p. 231)
- Q. Leaves more or less uniform; plant of  
freshwater areas.
- R. Blades with long-stalked sticky glands..  
.....*Drosera* (p. 193)
- R. Blades pubescent but not sticky-  
glandular.....*Myosotis* (p. 239)

- O. Flowers sessile or pedicellate but not arranged on one side of curved to helicoid inflorescence branches.
- S. Petals absent.....CHENOPODIACEAE (p. 173)
- S. Petals present.
- T. Petals 4.....*Cardamine* (p. 188)
- T. Petals 5 or 6.
- U. Stem armed with sharp spines.....*Hydrolea* (p. 239)
- U. Stem unarmed.....PRIMULACEAE (p. 229)

#### GROUP L

Plants with *SIMPLE, OPPOSITE OR WHORLED LEAVES BORNE ALONG A STEM* that is *NOT SUPPORTED BY THE WATER*

- A. Flowers in spikes or heads.
- B. Inflorescence a head subtended by 2 series of involucral bracts; ovary inferior.....ASTERACEAE (p. 268)
- B. Inflorescence a loose or compacted spike; ovary superior.
- C. Petals absent, the spike whitish due to the presence of dry, chaffy sepals; stamens 5.....*Alternanthera* (p. 176)
- C. Petals present, united into a tube with 4-5 lobes; stamens less than 5.
- D. Stamens 2.....*Justicia* (p. 261)
- D. Stamens 4.....VERBENACEAE (p. 239)
- A. Flowers not in heads or spikes.
- E. Ovary inferior or surrounded by a persistent staminal and perianth tube (hypanthium) and appearing to be inferior.
- F. Hypanthium completely fused to the truly inferior ovary.
- G. Leaves, at least some, whorled.....*Galium* (p. 263)
- G. Leaves opposite.....ONAGRACEAE (p. 209)
- F. Hypanthium fused to no more than the lower half of the ovary.
- H. Ovary separate from (but closely surrounded by) the hypanthium, appearing to be inferior but actually superior.....LYTHRACEAE (p. 202)
- H. Ovary fused by its lower half to the hypanthium, partially inferior; hypanthium extending above the ovary and becoming urn-shaped at maturity.....*Rhexia* (p. 206)
- E. Ovary superior and not tightly surrounded by an hypanthium.
- I. Flowers borne on one side of terminal curved or helicoid inflorescence branches.....*Cynoctonum* (p. 231)
- I. Flowers variously arranged but not on one side of terminal curved or helicoid inflorescence branches.
- J. Petals separate or absent.
- K. Petals absent.....URTICACEAE (p. 168)
- K. Petals present.
- L. Stipules present; leaves narrowly linear; plant of salt marshes and tidal flats.....*Spergularia* (p. 177)



- L. Stipules absent; leaves broad; plants of freshwater areas.
  - M. Petals deeply bilobed; capsule opening by 5 valves each of which is 2-cleft.....*Stellaria* (p. 177)
  - M. Petals not deeply bilobed; capsule opening by 3 valves none of which is cleft.....*Hypericum* (p. 200)
- J. Petals fused into a tube at least at base.
  - N. Calyx and/or corolla slightly to strongly zygomorphic; fertile stamens 2 or 4.
    - O. Fruit with 4 lobes surrounding the base of the style, breaking into 4 (or fewer by abortion) 1-seeded nutlets.....LAMIACEAE (p. 242)
    - O. Fruit a 2-carpellate capsule.....SCROPHULARIACEAE (p. 247)
  - N. Calyx and corolla regular; fertile stamens usually 5 or more.
    - P. Stamens fused to the corolla tube but not to each other.....GENTIANACEAE (p. 231)
    - P. Stamens fused together either by the filament bases or by the anthers.
      - Q. Stamens united by the filament bases...*Lysimachia* (p. 231)
      - Q. Stamens united by their anthers and also fused to the style; pollen distributed in pollinia, each pollinium consisting of the halves of two adjacent anthers.....*Asclepias* (p. 235)

RESTRICTED KEY  
TO PLANTS OF  
BRACKISH WATER, SALT MARSHES, AND MARINE AREAS  
*not including*  
*"freshwater" ditches, ponds, and swales in coastal areas*

- A. Leaves totally submersed or floating, lax, fully supported by the water.....Group A (p. 24)
- A. Leaves self-supporting, not lax and totally submersed, borne on either horizontal or erect stems.
  - B. Leaves basal only; erect stem, if present, not leafy except for bract(s) subtending the inflorescence...Group B (p. 25)
  - B. Leaves borne on an elongate, erect or prostrate stem.
    - C. Leaves opposite.....Group C (p. 26)
    - C. Leaves alternate.
      - D. Plant a monocot.....Group D (p. 27)
      - D. Plant a dicot.....Group E (p. 29)

GROUP A

Marine, brackish water or salt marsh plants with *LAX*, totally  
*SUBMERSED OR FLOATING LEAVES* fully supported by the water

- A. Plants permanently and totally submersed in marine areas; leaves basal, arising from rhizomes firmly anchored in the substrate.
  - B. Leaf with 3 nerves extending to the tip as three points (even when lacerated by wave action)...*Halodule beaudettei* (p. 39)
  - B. Leaf with 5 or more nerves, the tip rounded on the shoulders and without 3 prominent points.
    - C. Tip of leaf entire with a minute central point...  
.....*Zostera marina* (p. 39)
    - C. Tip of leaf serrulate, without a single median point (plant found in beach drift only, probably from more southern areas).....*Thalassia testudinum* (p. 72)
- A. Plants submersed in brackish water, never in marine areas (flowering portions sometimes emersed); leafy stem lax in the water, usually rooted in the substrate.
  - D. Leaves opposite.....*Zannichellia palustris* (p. 53)
  - D. Leaves alternate.
    - E. Base of leaf fused to the stipule; leaf linear-filiform to setaceous.
      - F. Fruit long-stipitate; leaf blade linear-filiform, without cross-partitions.....*Ruppia maritima* (p. 53)
      - F. Fruit sessile; leaf blade setaceous, with cross-partitions.....*Potamogeton pectinatus* (p. 47)
    - E. Base of leaf not fused to stipule; leaf broad and flat.
      - G. Leaf blade sharply serrulate.....*Potamogeton crispus* (p. 47)
      - G. Leaf blade entire.....*Potamogeton perfoliatus* (p. 52)

## GROUP B

Brackish water or salt marsh plants with *SELF-SUPPORTING BASAL LEAVES*  
only [except for bract(s) subtending the inflorescence]

- A. Leaves with broadened, flat blades narrowing to distinct petioles.
  - B. Leaf tip mucronate; stem, if present, with highly reduced, alternate, scale-like leaves; flowers individually arranged in a diffuse panicle.....*Limonium carolinianum* (p. 231)
  - B. Leaf tip not mucronate; stem leafless; flowers in whorls of 3.
    - C. Bracts glabrous and smooth, connate, membranous; leaf blades thin and herbaceous; filaments dilated at the base.....*Sagittaria graminea* (p. 66)
    - C. Bracts papillose, united only at base, firm; leaf blades coriaceous; filaments linear...*Sagittaria falcata* (p. 68)
- A. Leaves without broadened flat blades tapering to distinct petioles.
  - D. Flowers unisexual.
    - E. Individual flowers conspicuous, borne in whorls of 3..  
.....*Sagittaria graminea* (p. 66)
    - E. Individual flowers inconspicuous, borne in separate, elongated, dense, spike-like panicles, the male above, the female below; leaves long, linear, flat to plano-convex in cross-section.
      - F. Stigmas lanceolate to lance-ovate; bract of pistillate flower present on some flowers; pollen mostly 1-celled but with a few 4-celled packets; leaves flat to moderately convex on the back...  
.....*Typha glauca* (p. 34)
      - F. Stigmas linear; bract present on all pistillate flowers; pollen 1-celled; leaves moderately to strongly convex on the back.
        - G. Leaves strongly convex on the back, usually about 5-6 mm wide; pistillate inflorescence dark brown to reddish-brown, much overtopped by the leaves.....*Typha angustifolia* (p. 34)
        - G. Leaves moderately convex on the back, 6-12 mm wide; pistillate inflorescence cinnamon brown, as tall as, or slightly overtopped by, the leaves.....*Typha domingensis* (p. 35)
  - D. Flowers bisexual.
    - H. Leaves reduced to basal sheaths.
      - I. Flowers in several spikelets.....*Scirpus validus* (p. 132)
      - I. Flowers in a solitary terminal spikelet.
        - J. Perianth bristles present but unbarbed...  
.....*Eleocharis cellulosa* (p. 11)
        - J. Perianth bristles barbed or absent.
          - K. Tubercle confluent with apex of the nutlet.
            - L. Sheath loose and membranous, strongly oblique, nutlet 1-1.3 mm long.....*Eleocharis parvula* (p. 112)
            - L. Sheath tight, firm, truncate to oblique; nutlet 2-3 mm long.....*Eleocharis rostellata* (p. 112)
          - K. Tubercle distinctly differentiated from the apex of the nutlet.

- M. Basal scale not encircling the base of the spikelet; sheath loose, very strongly oblique and usually with red dots just below the lowest portion of the orifice.....*Eleocharis albida* (p. 113)
- M. Basal scale completely encircling the base of the spikelet; sheath tight, moderately oblique, without red dots below the orifice.
  - N. Rhizome coarse, 1.5-2 mm thick.....*Eleocharis fallax* (p. 112)
  - N. Rhizome slender, less than 1.5 mm thick..
    - .....*Eleocharis halophila* (p. 112)
- H. Leaves filiform, linear, subterete or terete.
  - O. Flower(s) solitary or in a raceme; leaves and flowering culm soft, delicate.
    - P. Inflorescence a solitary flower borne, along with tufted leaves, from a delicate creeping rhizome..
      - .....*Limosella subulata* (p. 249)
    - P. Inflorescence a raceme.....*Triglochin striata* (p. 55)
  - O. Flowers neither solitary nor in a raceme; leaves and flowering culm firm, coarse.
    - Q. Inflorescence terminal, consisting of pedicellate and/or sessile spikelets subtended by leafy bracts; flowers without sepals and petals.....*Fimbristylis spadicea* (p. 123)
    - Q. Inflorescence appearing to be lateral but actually terminal and subtended by a single bract which appears to continue the culm; flowers inconspicuous, with 3 sepals and 3 petals.....*Juncus roemerianus* (p. 159)

#### GROUP C

Brackish water or salt marsh plants with *SELF-SUPPORTING OPPOSITE LEAVES BORNE ON AN ERECT OR PROSTRATE STEM*

- A. Leaves reduced to obtuse, acute or sharp-pointed scales; flowers in 3's, imbedded in the thick, fleshy stem.
- B. Main stem horizontal, freely branching in the sand with numerous upright branches; central flower only slightly higher than the two lateral flowers; perennial.
  - .....*Salicornia virginica* (p. 174)
- B. Main stem erect; central flower conspicuously higher than the lateral flowers; annual.
  - C. Leaf scales sharply pointed and conspicuous...
    - .....*Salicornia bigelovii* (p. 174)
  - C. Leaf scales blunt to obtuse.....*Salicornia europaea* (p. 176)
- A. Leaves linear to broad.
  - D. Plant woody.
    - E. Leaf covered with a grayish-white pubescence, fleshy, obovate to oblanceolate, apex sharply mucronate; heads erect, bur-like in fruit.....*Borrchia frutescens* (p. 274)
    - E. Leaf green, lanceolate to elliptic, apex acute but not mucronate; heads pendant, not bur-like.....
      - .....*Iva frutescens* (p. 274)
  - D. Plant herbaceous.

- F. Stem either a vine or prostrate and creeping.
  - G. Plant a vine.....*Mikania scandens* (p. 274)
  - G. Plant creeping, with fleshy stem and leaves...
    - .....*Bacopa monnieri* (p. 249)
- F. Stem erect.
  - H. Leaves compound or at least deeply pinnately divided.
    - I. Nutlet ciliate, more than 5 mm long..*Bidens coronata* (p. 279)
    - I. Nutlet not ciliate, less than 5 mm long.....
      - .....*Bidens mitis* (p. 279)
  - H. Leaves simple, not deeply divided.
    - J. Base of leaf blade broad, widely cuneate to truncate or auriculate.
      - K. Leaf sessile.....*Ammannia latifolia* (p. 206)
      - K. Leaf petiolate.....*Atriplex patula* (p. 174)
    - J. Base of blade gradually tapering or leaf linear.
      - L. Leaves toothed.
        - M. Flowers white, in dense axillary clusters..
          - .....*Lycopus europaeus* (p. 244)
        - M. Flowers white, pinkish or blue, in terminal spikes.....*Verbena scabra* (p. 242)
      - L. Leaves entire.
        - N. Leaves more than 5 cm long..*Asclepias lanceolata* (p. 239)
        - N. Leaves less than 5 cm long.
          - O. Flowers inconspicuous; petals white, pinkish or violet, less than 4 mm long.
            - P. Stipules present; pedicel and sepals glandular-stipitate.....*Spergularia marina* (p. 177)
            - P. Stipules not present; pedicel and sepals glabrous.....*Lythrum lineare* (p. 206)
          - O. Flowers conspicuous; petals 1-4 cm long, pink, rose-violet or rarely white.
            - Q. Petals fused at base only..*Sabatia stellaris* (p. 235)
            - Q. Petals fused for more than half of length..
              - .....*Agalinis maritima* (p. 250)

#### GROUP D

Brackish water or salt marsh *MONOCOTYLEDONOUS* plants with  
*SELF-SUPPORTING ALTERNATE LEAVES* borne either *ON AN ERECT*  
*OR PROSTRATE STEM*

- A. Leaves terete and septate, flowers with 3 sepals and 3 petals..
  - .....*Juncus megacephalus* (p. 161)
- A. Leaves flat or triangular in cross-section (perhaps revolute and appearing terete but not septate).
  - B. Sheath of leaf closed.
    - C. Nutlet enclosed in a perigynium.....*Carex divisa* (p. 100)
    - C. Nutlet not enclosed in a perigynium.
      - D. Scales of spikelet distichous.....*Cyperus filicinus* (p. 118)
      - D. Scales of spikelet spirally imbricated.
        - E. Stem terete or nearly so; leaves harshly serrulate on the margins.....*Cladium jamaicense* (p. 121)
        - E. Stem sharply triangular.



- F. Inflorescence with few spikelets, appearing to be lateral but actually terminal, the single involucre bract erect and appearing to be a continuation of the culm.....*Scirpus olneyi* (p. 132)
- F. Inflorescence of several spikelets, obviously terminal, the several involucre bracts leaf-like.
  - G. Spikelet ovoid; bristles of nutlet deciduous...  
.....*Scirpus robustus* (p. 133)
  - G. Spikelet narrowly ovoid to elliptic-cylindric; bristles of nutlet persistent.....  
.....*Scirpus cylindricus* (p. 133)
- B. Sheath of leaf open.
  - H. Spikelets with few-to-many fertile flowers; leaves strongly 2-ranked.....*Distichlis spicata* (p. 75)
  - H. Spikelets each bearing only one fertile floret.
    - I. Spikelet unisexual; both pistillate and staminate spikelets borne on the same inflorescence.
      - J. Pistillate spikelets on the ascending upper branches, the staminate on the spreading lower branches.....*Zizania aquatica* (p. 92)
      - J. Pistillate and staminate spikelets intermixed on the same branches.....*Zizaniopsis miliacea* (p. 92)
    - I. Spikelets bisexual.
      - K. Both glumes of the spikelet long awned...  
.....*Polypogon monspeliensis* (p. 86)
      - K. Both glumes awnless or only the 1st glume awned.
        - L. Spikelets loosely arranged in the inflorescence, without evident crowding on one side of the inflorescence branches.....*Panicum virgatum* (p. 90)
        - L. Spikelets crowded on one side of the panicle branches.
          - M. Spikelets plano-convex, with a sterile lemma below the fertile floret.
            - N. Second glume pubescent.....*Paspalum distichum* (p. 86)
            - N. Second glume glabrous.....*Paspalum vaginatum* (p. 86)
          - M. Spikelets laterally compressed, without a sterile lemma.
            - O. Leaf blade less than 3 mm wide.....  
.....*Spartina patens* (p. 82)
            - O. Leaf blade 4 mm or more wide.
              - P. Margin of leaf smooth to slightly scabrous; inflorescence with erect branches.....  
.....*Spartina alterniflora* (p. 82)
              - P. Margins of leaf strongly scabrous; inflorescence branches ascending to spreading.....*Spartina cynosuroides* (p. 82)

## GROUP E

Brackish water and salt marsh *DICOTYLEDONOUS* plants with  
*SELF-SUPPORTING ALTERNATE LEAVES* borne either *ON AN ERECT*  
*OR PROSTRATE STEM*

- A. Flowers in dense heads.
  - B. Bracts subtending the heads tridentate..*Eryngium aquaticum* (p. 226)
  - B. Bracts subtending the heads not tridentate.
    - C. Plant woody.....*Baccharis angustifolia* (p. 268)
    - C. Plant herbaceous.
      - D. Flowering heads overlapping in elongated and curving panicles, the panicle branches tending to be ascending on the convex side of the main axis.....*Solidago sempervirens* (p. 268)
      - D. Flowering heads in an open or compacted inflorescence but not curving as above.
        - E. Nutlet with 5 distinct ribs, cylindric; ray flowers absent.....*Pluchea purpurascens* (p. 269)
        - E. Nutlet not 5-ribbed, tapering from base to apex, ellipsoid to oblanceolate; ray flowers present.
          - F. Ligule of ray flowers more than 5 mm long; heads mostly more than 10 mm wide.....*Aster tenuifolius* (p. 272)
          - F. Ligule of ray flowers less than 5 mm long; heads less than 10 mm wide.
            - G. Inflorescence of many heads in a diffuse panicle; heads 7-9 mm long; ligule 1-3 mm long, becoming outwardly coiled, barely, if at all, exceeding the pappus.....*Aster subulatus* (p. 272)
            - G. Inflorescence of few-to-many heads in a racemose panicle with ascending branches; heads 5-6 mm long; ligule up to 4 mm long, exserted and obvious.....*Aster racemosus* (p. 272)
- A. Flowers not in dense heads.
  - H. Basal leaves present, larger than the upper leaves, rounded toward the tip.
    - I. Basal leaves thick and fleshy, mucronate; upper leaves becoming reduced to scales.....*Limonium carolinianum* (p. 231)
    - I. Basal leaves thin, not fleshy, blunt; upper leaves smaller than the basal leaves but not reduced to scales..
      - .....*Samolus parviflorus* (p. 231)
  - H. Basal leaves, if present, and upper similar.
    - J. Leaves broad, densely stellate-pubescent at least below.
      - K. Stem, peduncles and leaves harshly pubescent; petals no more than 3.5 cm long.....*Kosteletzkya virginica* (p. 198)
      - K. Stem, peduncles and leaves glabrous to soft pubescent; petals 6-10 cm long.....*Hibiscus moscheutos* (p. 198)
    - J. Leaves with linear to lanceolate blades, glabrous or, if pubescent, not stellate.
      - L. Leaves mostly opposite or occasionally whorled; sepal lobes alternating with appendages.....*Lythrum lineare* (p. 206)

- L. Leaves all alternate; sepal appendages absent.
- M. Sepal lobes 4.....*Ludwigia lanceolata* (p. 218)
- M. Sepal lobes 5.
  - N. Leaves toothed; corolla two-lipped; ovary inferior.....*Lobelia elongata* (p. 266)
  - N. Leaves entire; corolla absent; ovary superior..  
.....*Suaeda linearis* (p. 176)



MARSH and AQUATIC VASCULAR PLANTS of NORTH CAROLINA  
Arranged by Family

-- ISOETACEAE --

1. ISOETES: *Quillwort*

Small herbaceous plants with quill-like leaves arising from a very short stem, growing submersed or in areas periodically inundated. The swollen leaf bases enclose either micro- or megasporangia. Flowers and seeds are not produced.

- a. Leaves with brownish to blackish lustrous bases; megaspores nearly smooth or with depressed tubercles and wrinkles.....1. *I. melanopoda*
- a. Leaves with straw-colored bases; megaspores with irregularly crested or reticulate surfaces.
  - b. Surface of megaspores with irregular crests, not forming a reticulate network; crests remotely jagged or with blunt processes; leaves without peripheral vascular strands; sporangia 4-7 mm long.....2. *I. riparia*
  - b. Surface of megaspore with more-or-less regular reticulation; crests thin, sometimes spiny; leaves usually with 4 peripheral vascular strands; sporangia 6-12 mm long.....3. *I. engelmannii*

1. *Isoetes melanopoda* Gay & Durieu

Locally abundant in shallow pools on granite, in wet fields, and along stream margins throughout the Piedmont and southern half of the Coastal Plain in North Carolina. Extending northward into West Virginia, southward into Georgia and westward into Iowa, Oklahoma, and Texas. [Includes *I. melanospora* Engelm., *I. butleri* Engelm., *I. virginica* Pfeiff.]

2. *Isoetes riparia* Engelm.

Infrequent in shallow water of fresh to slightly brackish marshes and tidal shores of the Coastal Drainage System in the northern portion of the Coastal Plain in North Carolina. Extending northward into Ontario and Maine. [Includes *I. saccharata* Engelm.]

3. *Isoetes engelmannii* A. Braun

Locally abundant in various shallow water habitats throughout North Carolina. Extending southward into Florida, westward into Missouri and northward into New York, Vermont, and New Hampshire.



The texture of megaspore reticulation varies extensively and might provide an excellent topic for experimental analysis.

-- AZOLLACEAE --

Small free-floating plants (or stranded on mud) with branching stems concealed by minute, numerous, closely spaced, two-lobed leaves some of which bear sporocarps containing micro- or megasporangia on

the lower lobe. Flowers and seeds are not produced. These plants often become very abundant, forming green or rusty-red mats floating on the water.

# 1. AZOLLA: Mosquito Fern, Water Fern, Water-velvet

## 1. *Azolla caroliniana* Willd.

Frequent and locally abundant as a mat-forming, free-floating aquatic in ponds, sloughs, and sluggish streams throughout the eastern half of the

Coastal Plain (less frequent in the remainder of the Coastal Plain) and infrequent in the Piedmont of North Carolina. Extending southward into Florida, northward into Massachusetts and westward to the Pacific.



# --TAXODIACEAE--

## 1. TAXODIUM: Bald-cypress

Large monoecious trees with alternate leaves borne on slender branches which fall with the leaves. Male cones are herbaceous and clustered on drooping branches. Female cones are woody and subglobose, with peltate scales. The roots often, especially in very moist or aquatic habitats, send up projections known as "Cypress Knees".

Some authors distinguish two species in North Carolina, *T. distichum* (with spreading leaves arranged in essentially one plane) and *T. ascendens* (with spirally arranged leaves more-or-less appressed to the stem. Although experimental studies are needed to clarify the situation, the author is of the opinion that *Taxodium* in the southeastern United States should be treated as one species possessing considerable genetic and/or environmentally induced variability.

## 1. *Taxodium distichum* (L.) Rich.

Common in swamps, sloughs, ponds, and along sluggish streams in the Coastal Plain of North Carolina. Extending northward into New Jersey,

southward into Florida and westward into Illinois, Missouri, Arkansas, Oklahoma, and Texas. [Includes *T. ascendens* Brongn.]



# --TYPHACEAE--

## 1. TYPHA: Cat-tail

Monoecious plants of wet soil and shallow water that produce extensive rhizomes and erect leafless stems sheathed at the base by linear-elongate leaves. The unisexual flowers are individually inconspicuous but are densely packed in conspicuous cylindrical spike-like (actually a reduced panicle) inflorescences, the male above, the female below. Both male and female inflorescences are sometimes interrupted by deciduous-leafy spathes.

Each female flower possesses a long-stalked ovary subtended by numerous long silky hairs. The sterile female flowers are especially long-stalked and do not produce either a style or stigma. In some species the female flower is subtended by a bract. Hotchkiss and Dozier (1949) provide an excellent descriptive treatment of our species.

ISOETES

AZOLLA

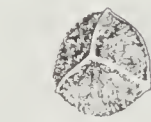
TAXODIUM



x 1/2

x 20

*I. melanopoda*



x 20

*I. riparia*



x 20

*I. engelmannii*



x 5

*A. caroliniana*



x 1



x 1



♀ CONE

x 1

*T. distichum*

Much variation exists among cat-tail populations and should be studied experimentally. However, the following appear to be reasonably distinct species except that *T. glauca* gives evidence of intermediate nature between *T. latifolia* and *T. angustifolia*. Smith (1967) and Lee (1975) provide excellent analytic data on this point.

- a. Stigmas lanceolate to ovate; bract of pistillate flower absent or present on only a few scattered flowers; staminate and pistillate portions confluent or up to 8 cm distant; leaves 6-20 mm wide, flat to moderately convex on the back.
- b. Pollen consisting mostly of 4-celled packets; stigmas lance-ovate; bract of pistillate flowers absent; staminate and pistillate portions usually confluent; pistillate portion usually thicker toward the top; leaves flat to moderately convex toward the base.....1. *T. latifolia*
- b. Pollen mostly 1-celled; stigma lanceolate; bracts present on a few scattered pistillate flowers; staminate and pistillate portions usually distinct; pistillate portion uniform in thickness; leaves usually moderately convex on the back.....2. *T. glauca*
- a. Stigmas linear; bract present on each pistillate flower; staminate and pistillate portions distinct by at least 0.5 cm; leaves 3-12 mm wide, moderately to strongly convex on the back.
- c. Leaves strongly convex on the back, usually about 5-6 mm wide; pistillate portion dark brown to reddish-brown, much overtopped by the leaves.....3. *T. angustifolia*
- c. Leaves moderately convex on the back, 6-12 mm wide; pistillate portion cinnamon brown, as tall as or slightly overtopped by the leaves.....4. *T. domingensis*

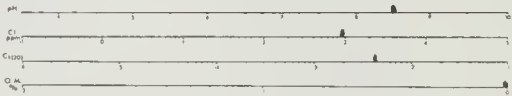
1. *Typha latifolia* L., Common Cat-tail

Common in shallow water and moist areas throughout North Carolina. Extending throughout most of the United States.



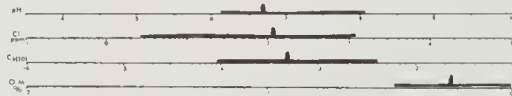
2. *Typha glauca* Godr., Giant Cat-tail

Infrequent in shallow fresh to slightly brackish water in the outer Coastal Plain of North Carolina. Extending northward into Maine, southward into Alabama and westward into Iowa and South Dakota; California.



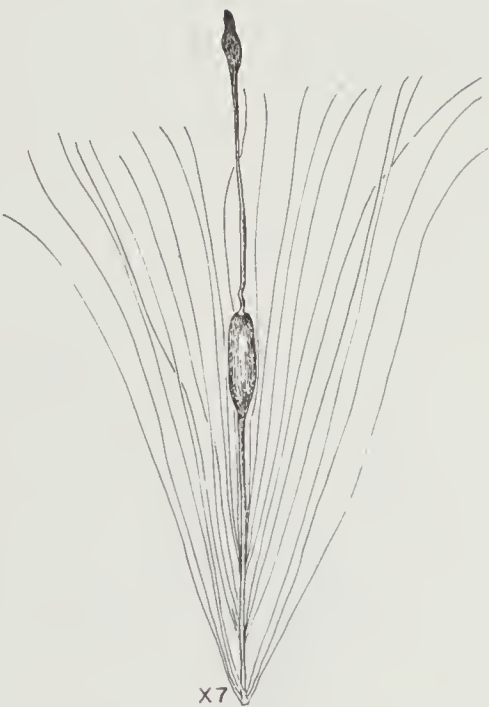
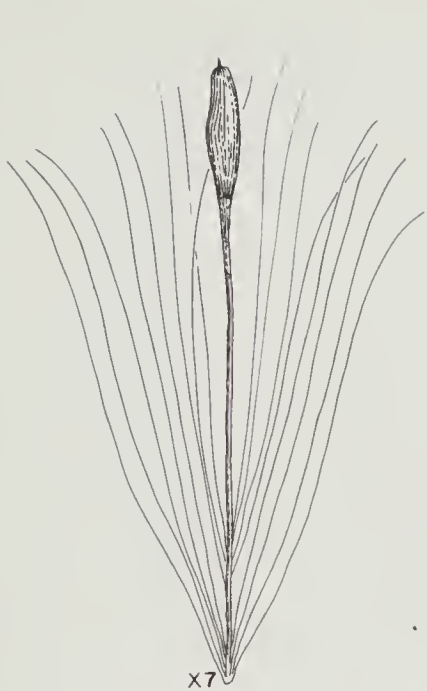
3. *Typha angustifolia* L., Narrow-leaved Cat-tail

Common in shallow fresh to brackish water in the outer Coastal Plain of North Carolina. Extending southward into Florida, northward into Maine and westward into West Virginia, Nebraska, Kansas, and Texas; Pacific and southwestern states.





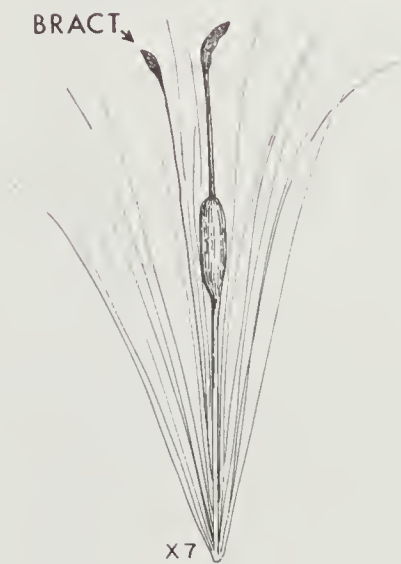
TYPHA



*T. latifolia*

STERILE ♀ FLOWERS

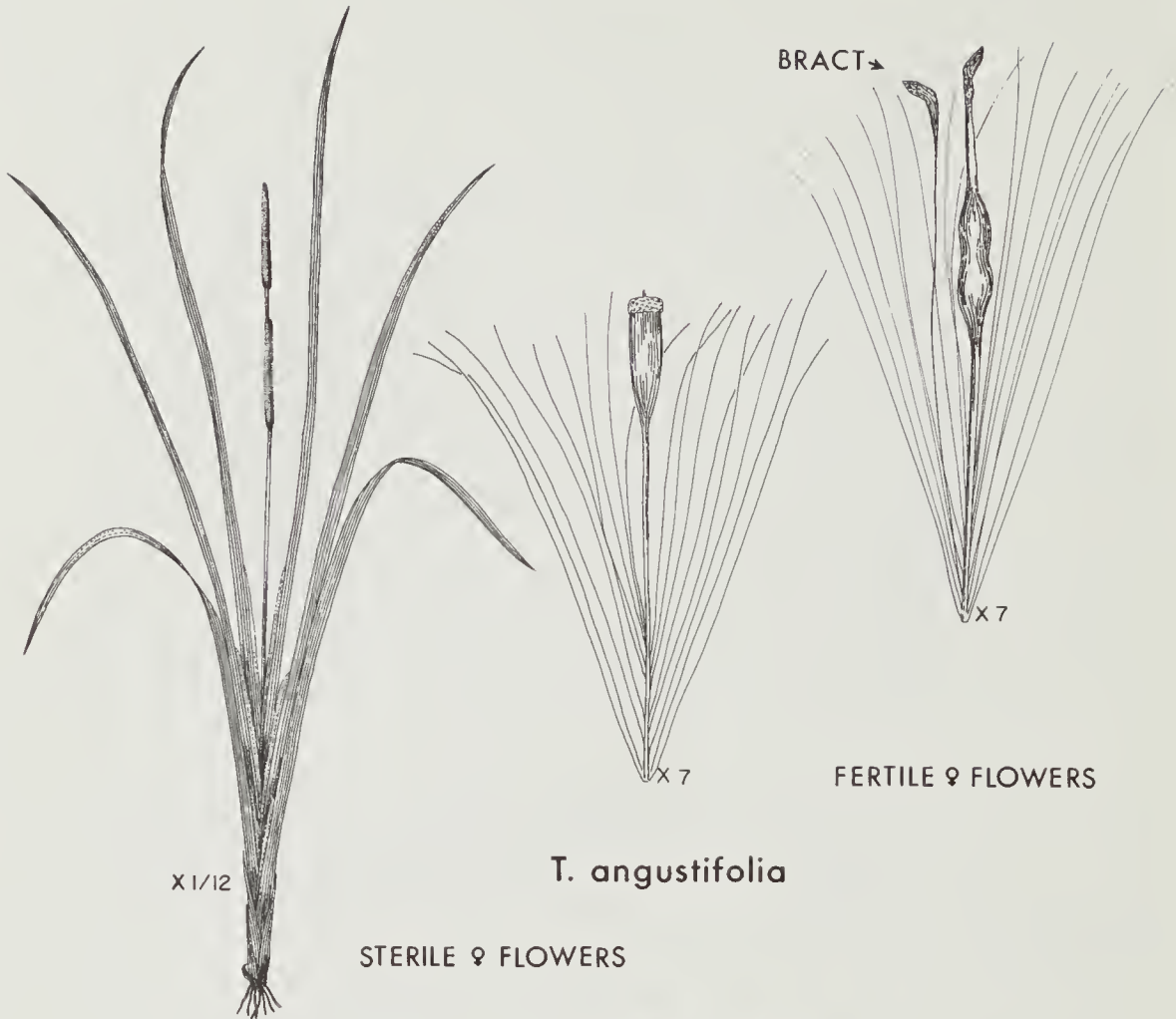
FERTILE ♀ FLOWERS



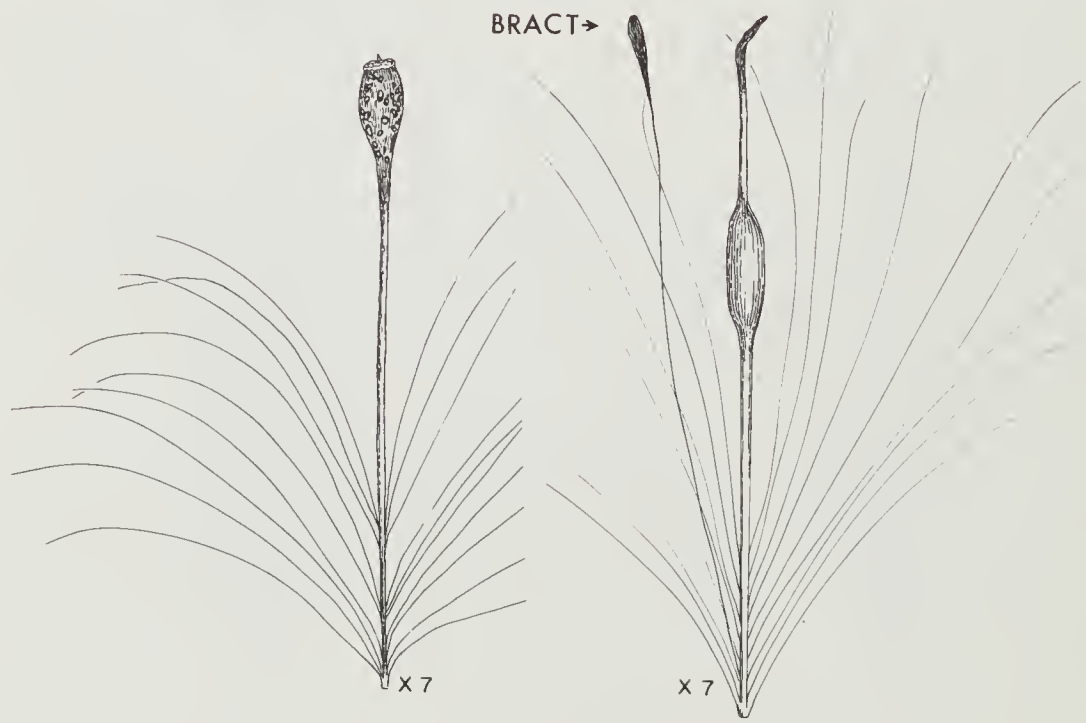
*T. glauca*



TYPHA



*T. angustifolia*



*T. domingensis*

4. *Typha domingensis* Pers., Southern Cat-tail

Locally abundant in brackish marshes in the outer Coastal Plain of North Carolina. Extending northward into Maryland, southward into Florida, and westward, in coastal areas, into Texas and California; inland in alkaline areas of the midwestern and western states.



--SPARGANIACEAE--

1. SPARGANIUM: Bur-reed

Monoecious plants of wet soil or shallow water that produce extensive rhizomes and erect stems with linear-elongate cauline and basal leaves (some northern species grow in deep water and produce floating leaves). The unisexual flowers are individually inconspicuous but clustered in conspicuous globose heads on a simple or branched axis, the male heads above, the female below. Persistent styles of the female flowers give the female head a bur-like appearance.

Much morphological variability exists in *S. americanum* (Beal, 1960a) but whether that variability is the result of genetic and/or ecological factors can be determined only by experimental studies that have not been attempted.

- a. Pistillate heads (at least one) supra-axillary; inflorescence simple or occasionally branched; mature fruit lustrous, usually conspicuously dotted with red on the lower half; stigma 0.8-2 mm long...1. *S. chlorocarpum*
- a. Pistillate heads axillary (rarely supra-axillary or on supra-axillary branches); inflorescence simple to much branched; mature fruit dull or lustrous, rarely dotted with red on the lower half; stigma 0.6-4.5 mm long.
- b. Mature fruit dull, finely pitted; branches of the inflorescence bearing 1-3 (rarely 0) pistillate heads and 1-6 staminate heads.....2. *S. americanum*
- b. Mature fruit lustrous, smooth; branches of the inflorescence bearing only staminate heads (rarely 1 pistillate head).....3. *S. androcladum*

1. *Sparganium chlorocarpum* Rydb.

Locally abundant on muddy shores of lakes in Avery and Watauga counties of North Carolina. Extending northward into Maine and westward into Indiana, Illinois, Iowa, and Minnesota. Also in a few northwestern states.



2. *Sparganium americanum* Nutt.

Common in shallow muddy streams and lake margins throughout the Coastal Plain and Blue Ridge provinces, but less frequent in the Piedmont Province of North Carolina. Extending northward into Maine, southward into Florida and westward into North Dakota, Missouri, Oklahoma, and Texas.



# SPARGANIUM



X 2.5

X 1/4

*S. americanum*

X 2.5

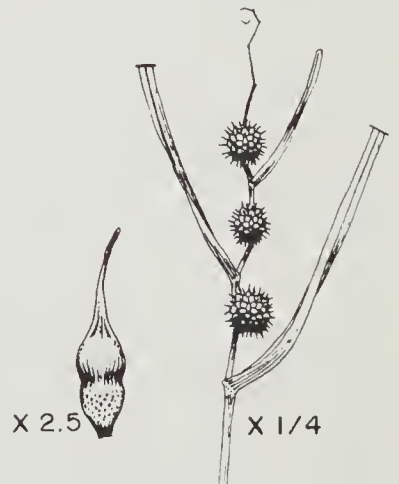


X 2.5



X 1/4

*S. androcladum*



X 2.5

X 1/4

*S. chlorocarpum*

A.T. Olive

3. *Sparganium androcladum* (Engelm.) Morong

Not known to occur in North Carolina. However, it does exist in southern Virginia and eastern Tennessee, and can be expected in North Carolina. Extending northward into Maine and westward into Minnesota, Iowa, Missouri, and Oklahoma.

--ZOSTERACEAE--

- a. Leaf with 3 nerves extending to the tip as 3 points, the one central point larger and the two lateral points smaller (even when lacerated by wave action); flowers borne in the leaf axils.....1. *Halodule*
- a. Leaf with 5 or more nerves, the tip rounded on the shoulders and with a minute central point; flowers borne on a one-sided spadix.....2. *Zostera*

1. HALODULE

Submersed marine plants with slender, creeping stems rooting at the nodes and producing short, erect branches sheathed by linear leaves that terminate in apices with three points, which are the extensions of the midrib and the two marginal veins.

1. *Halodule beaudettei* (Den Hartog) Den Hartog

Locally abundant, forming dense beds in saline bays and creeks along the coast, in Carteret, Dare and Onslow counties of North Carolina. Extending southward into Florida and westward to Texas. [*H. wrightii* Aschers.]

2. ZOSTERA: *Eel-grass*

Submersed marine plants producing slender creeping rhizomes and linear-elongate leaves with bases sheathing the joints of the stems. The unisexual sessile flowers are mixed in linear rows on the upper side of a leaf-like spathe.

1. *Zostera marina* L.

Locally abundant, forming dense beds in saline streams and bays along the coast. Extending the length of the Atlantic Coast from Maine to Florida; Pacific Coast.

--POTAMOGETONACEAE--

1. POTAMOGETON: *Pondweed*

Plants of fresh or brackish water producing rhizomes from which arise long, lax, submersed stems bearing submersed (and in some species floating) alternate leaves with stipules as well as axillary or terminal spikes of opposite or whorled flowers. Sepals and petals are not produced but each of the four anthers of a flower develops an expanded "sepaloid connective" which, at first glance, appears to be a sepal. Four separate carpels produce, except in cases of abortion, four sessile fruits per flower.

Most of the species of *Potamogeton* in North Carolina are fairly clearly delimited. However, two species complexes, *P. diversifolius/capillaceus* and *P. pusillus/berchtoldii* exhibit extensive morphological

# HALODULE

# ZOSTERA



H. beaudettei



Z. marina



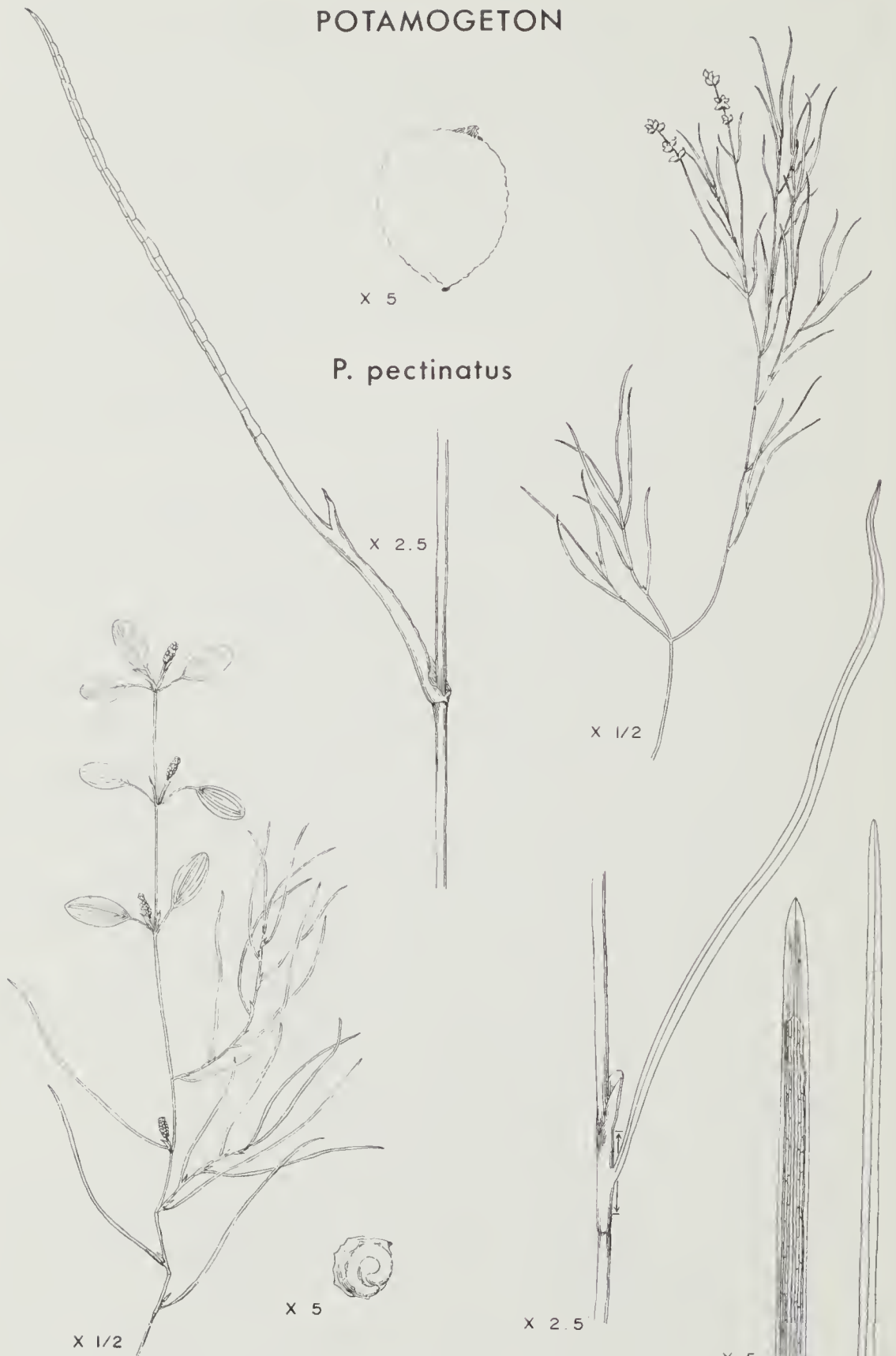
intergradation. The former has been combined into *P. diversifolius* by Klekowski and Beal (1965) and the latter into *P. pusillus* by both Haynes (1974) and Ogden (1974a). The following treatment reflects both of these combinations. Both of these complexes would make ideal subjects for experimental analyses.

Ogden (1943, 1974b) provides information on the stem anatomy of various species of *Potamogeton*. Anatomical features of the stem, although somewhat inconvenient for the field taxonomist, provide excellent diagnostic characters and should be utilized when the identity of a specimen is otherwise in question.

- a. Leaf base fused to the stipule.
  - b. Leaves septate by straight cross-partitions, setaceous..
    - .....1. *P. pectinatus*
  - b. Leaves not septate.
    - c. Midrib absent; leaf broadly linear but thickened, with several equal veins.....*Heteranthera* (p.149)
    - c. Midrib present; leaves flat; submersed leaves narrowly linear to setaceous.
      - d. Floating leaves normally produced, narrowly to broadly elliptic; submersed leaves narrowly linear, flat, the stipule fused for two-thirds length or less; fruit sessile.....2. *P. diversifolius*
      - d. Floating leaves never produced; submersed leaves narrowly linear to setaceous, the stipule fused for almost total length; fruit long-stalked.....*Ruppia* (p. 53)
- a. Leaf base free from the stipule.
  - e. Blade of leaf sharply serrulate to the naked eye.....3. *P. crispus*
  - e. Blade of leaf entire to the naked eye.
    - f. All leaves narrowly linear and submersed.
      - g. Leaves 0.1-0.5 mm wide, with one nerve, apex very long-tapered.....4. *P. confervoides*
      - g. Leaves 0.3-10 mm wide, up to 13 nerved, apex obtuse to acute but not long-tapered.
        - h. Midrib bordered by a broad band of conspicuous lacunae on each side; leaves 2-10 mm wide.....5. *P. epihydrus*
        - h. Midrib bordered by 0-5 rows of inconspicuous lacunae on each side; leaves 0.3-2.7 mm wide.
          - i. Fruit with an undulate dorsal keel; leaves usually without a pair of basal glands.....6. *P. foliosus*
          - i. Fruit rounded on the back; glands at base of leaf usually present.....7. *P. pusillus*
    - f. All or at least the upper (floating) leaves not linear but ovate to narrowly elliptical.
      - j. Submersed leaves linear, less than 2 mm wide; floating leaf blades attached to the petioles by a short, brownish, curved joint; endodermal cells of the U-type.....8. *P. natans*
      - j. Submersed leaves more than 2 mm wide; floating leaves not jointed at the distal portion of the petiole; endodermal cells of the 0-type (except in *P. illinoensis*).
      - k. Midrib of submersed leaves bordered by conspicuous rows of lacunae.....5. *P. epihydrus*
      - k. Midrib of submersed leaves not bordered by conspicuous lacunae.

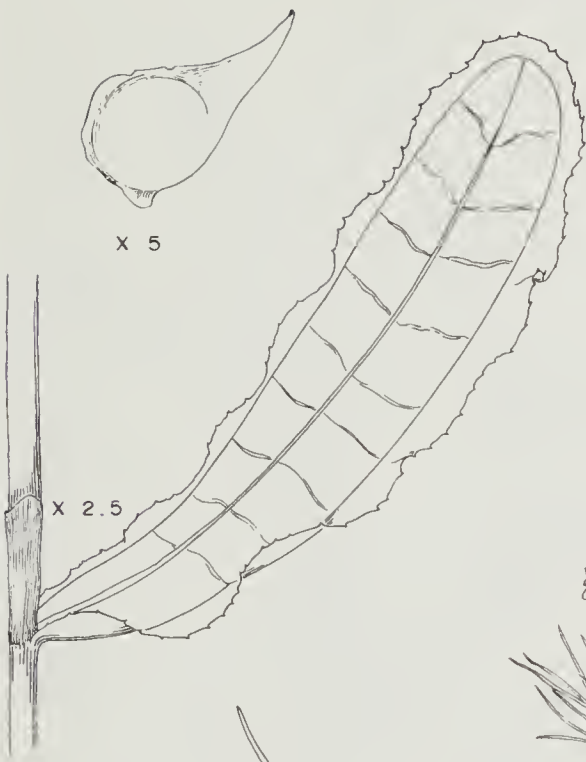
# POTAMOGETON

*P. pectinatus*



*P. diversifolius*

POTAMOGETON



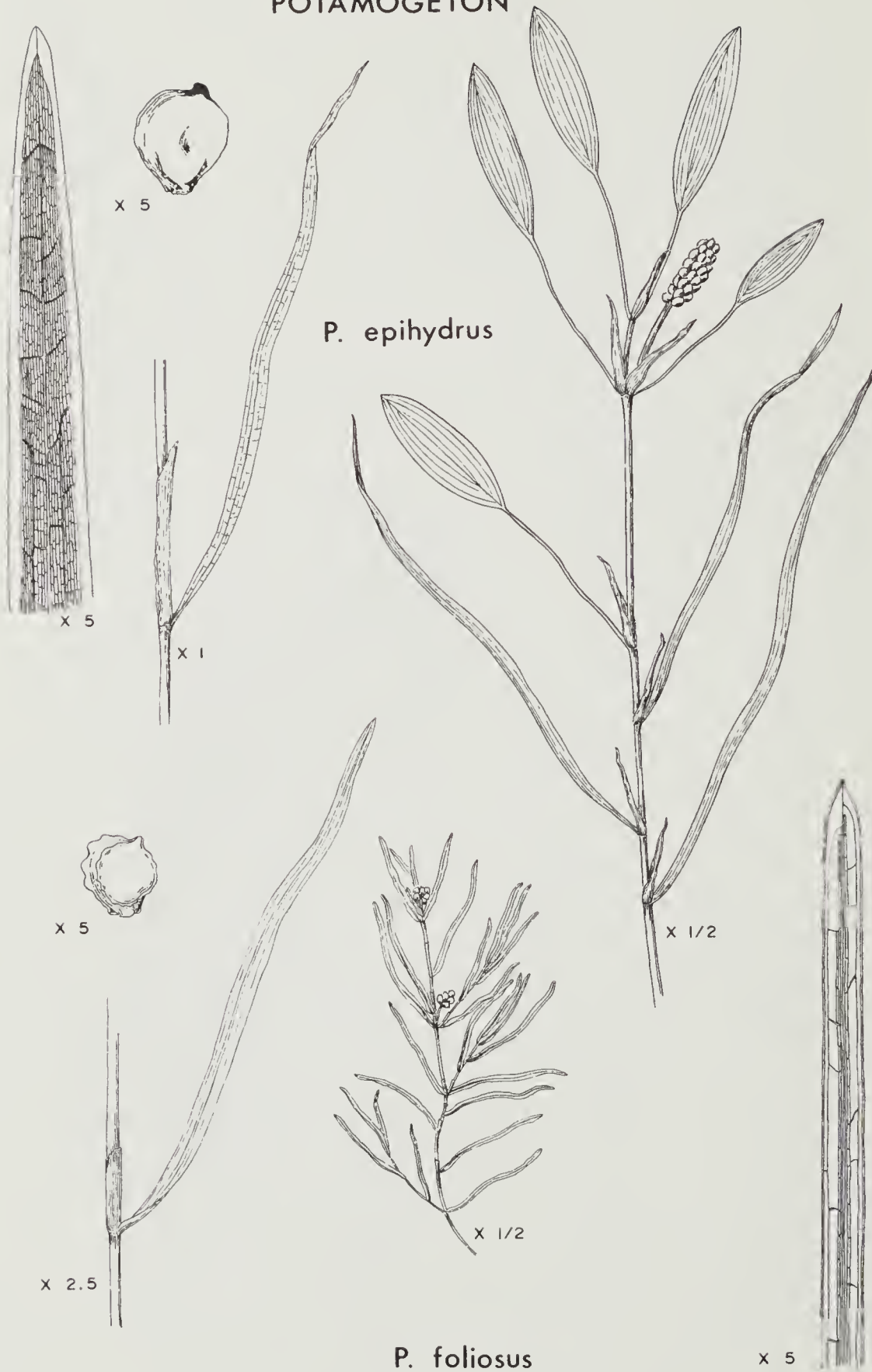
P. crispus



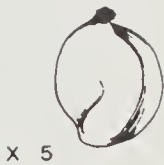
P. confervoides



POTAMOGETON



POTAMOGETON



P. pusillus



# POTAMOGETON



1. Leaves all sessile, cordate, and clasping the stem; lower and upper leaves similar; specialized floating leaves never produced.....9. *P. perfoliatus*
1. Leaves sessile or petiolate but not clasping the stem; specialized floating leaves normally produced.
  - m. Stem conspicuously black-spotted; floating leaves cordate to rounded at base.....10. *P. pulcher*
  - m. Stem not conspicuously black-spotted; floating leaves tapered to rounded at base.
    - n. Floating leaves with 30-51 nerves; margins of submersed leaves without one-celled translucent denticles.....11. *P. amplifolius*
    - n. Floating leaves with 9-29 nerves; margins of submersed leaves with minute one-celled translucent denticles.
      - o. Submersed leaves with petioles up to 13 cm long, acute but without abruptly pointed tip; endodermal cells of the O-type.....12. *P. nodosus*
      - o. Submersed leaves sessile or on petioles rarely as long as 4 cm, tips abruptly pointed; endodermal cells of the U-type.. .....13. *P. illinoensis*

1. *Potamogeton pectinatus* L., Sago Pondweed

Locally abundant in brackish or calcareous water in the outer Coastal Plain of North Carolina. Extending throughout the United States in similar habitats--partially due to introductions as a wildfowl food.



2. *Potamogeton diversifolius* Raf.

Abundant in streams and ponds throughout North Carolina. Extending northward into New England, southward into the Gulf states and westward to the Great Plains; sporadic occurrence in the western states. [Includes *P. capillaceus* Poir.]

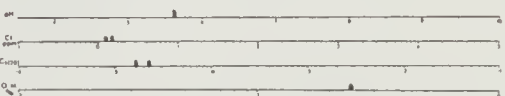


3. *Potamogeton crispus* L.

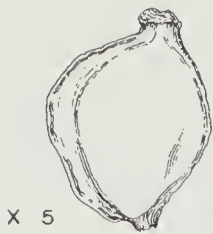
Known in North Carolina only from Hertford, McDowell, and Wilkes counties. Extending northward into the New England states, southward into Alabama and westward into Minnesota, Iowa, Oklahoma, and Texas; sporadic occurrence in the western states.

4. *Potamogeton confervoides* Reich.

Known in North Carolina only from Moore, Richmond, and Scotland counties. Otherwise extending from New Jersey and Pennsylvania northward into the New England States; Wisconsin and Michigan.



POTAMOGETON



X 5



X 5



P. pulcher

X 1/2



X 1/2

X 1.5

P. perfoliatus

POTAMOGETON



*P. amplifolius*

POTAMOGETON



*P. nodosus*



POTAMOGETON

X 5



SUBMERSED  
LEAF  
MARGIN →



X 75

X 1/2



*P. illinoensis*

ENDODERMAL  
CELLS →



X 523

X 1



5. *Potamogeton epihydrus* Raf.

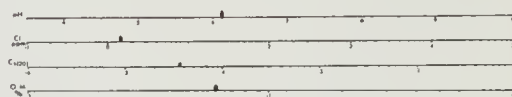
Locally abundant in streams and ponds of the Blue Ridge Province, along the Fall Line, and in Brunswick and Pender counties of North Carolina.

Extending northward into New England, southward into Georgia and westward into Minnesota, Iowa, Missouri, Tennessee, and Louisiana; northwestern states.



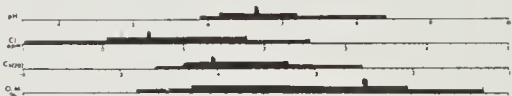
6. *Potamogeton foliosus* Raf.

Locally abundant in scattered locations in the Blue Ridge Province and in Duplin, Jones, and Carteret counties in the Coastal Plain. Extending throughout the United States.



7. *Potamogeton pusillus* L.

Abundant in brackish to freshwater streams, pools, and ponds throughout North Carolina. Extending throughout the United States. [Includes *P. berchtoldii* Fieber]

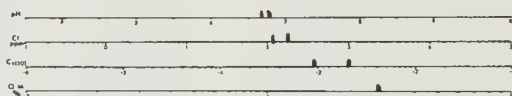


8. *Potamogeton natans* L.

The only known occurrence of this species in North Carolina (Lake Louise, Buncombe Co.) probably represents a temporary introduction. The species is not known to exist in the state at the present time. Widespread throughout the northern and western portions of the United States.

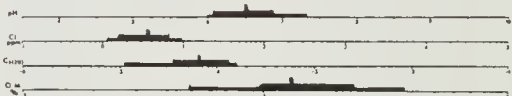
9. *Potamogeton perfoliatus* var. *bupleuroides* (Fern.) Farw.

Locally abundant in calcareous and brackish waters in the northern half of the outer Coastal Plain of the North Carolina. Extending northward into Maine, southward, along the Atlantic and Gulf states, into Texas and westward, in the Great Lakes states, into Minnesota.



10. *Potamogeton pulcher* Tuck.

Common in ponds and streams throughout the Coastal Plain but less frequent in the Piedmont and Blue Ridge provinces of North Carolina. Extending northward into New England, southward into Florida and westward into Minnesota, Oklahoma, and Texas.

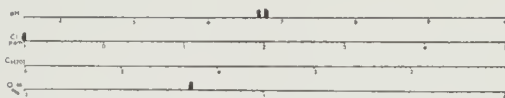


11. *Potamogeton amplifolius* Tuck.

Locally abundant in ponds and sluggish streams in Columbus, Carven, and Wilson counties of North Carolina. Extending northward into Maine, southward into Georgia and westward into the Dakotas, Nebraska, Kansas, Oklahoma, and Texas; northwestern states.

12. *Potamogeton nodosus* Poir.

Locally abundant in ponds and streams in Carteret, Haywood, Perquimans, and Vance counties of North Carolina. Extending throughout the United States.



13. *Potamogeton illinoensis* Morong

Locally abundant in ponds and streams in Brunswick and Dare counties of North Carolina. Extending throughout the United States.



--RUPPIACEAE--

1. RUPPIA: *Widgeon-grass*, *Ditch-grass*

Submersed plants of brackish water producing rhizomes from which arise long, slender, lax stems with alternate, narrowly-linear leaves. The stipules are fused to the leaf bases and sheathe the stem. Flowers arise from a leaf sheath and, at maturity, each fertile flower produces 4 long-stalked fruits, except in cases of abortion.

1. *Ruppia maritima* L.

Abundant in brackish streams, ditches, and ponds in the outer Coastal Plain of North Carolina. Extending throughout the United States except inland states east of the Mississippi.



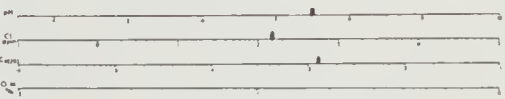
--ZANNICHELLIACEAE--

1. ZANNICHELLIA: *Horned Pondweed*

Submersed plants of fresh to slightly brackish water producing slender creeping rhizomes from which arise lax stems with opposite linear leaves. Both male and female flowers are without perianth. Each fertile flower produces 2-8 short-stalked, curved-cylindric, beaked, axillary fruits which are often dorsally dentate.

1. *Zannichellia palustris* L.

Infrequent in quiet waters, usually slightly brackish, in the outer Coastal Plain of North Carolina. Extending throughout the United States.



--NAJADACEAE--

1. NAJAS: *Naiad*, *Water Nymph*

Submersed plants of freshwater areas with lax stems, opposite leaves, and fibrous roots. The leaves are characteristically serrate and broadened at the base. Both male and female flowers are without perianth and are axillary. Each fertile flower produces one ellipsoid, thin-walled fruit containing one large seed with surface reticulations characteristic of the species.

RUPPIA



*R. maritima*

- a. Sheathing base of the leaf with gradually sloping or rounded shoulders; margin of the leaf with 20-60 spinules; leaf blade 21-46 cells wide in basal non-spinuled areas; fruit equilateral.....1. *N. guadalupensis*
- a. Sheathing base of the leaf subtruncate to distinctly auriculated; margin of the leaf with 6-20 spinules; leaf blade 5-16 cells wide in basal non-spinuled areas; fruit slightly asymmetrical.
- b. Leaf blade 5-9 cells wide in basal non-spinuled areas; leaf-sheath scarious; leaves prolonged spiny-toothed, slender, not stiff or recurved.....2. *N. gracillima*
- b. Leaf blade 9-16 cells wide in basal non-spinuled areas; leaf-sheath herbaceous; leaves short-toothed, stiff and recurved.....3. *N. minor*

1. *Najas guadalupensis* (Spreng.) Magnus  
 Abundant in ponds, lakes, and quiet waters chiefly in the outer Coastal Plain but also locally abundant throughout North Carolina. Extending northward into New England, southward into Florida and westward into South Dakota, Colorado, Oklahoma, and Texas; California, Idaho, and Oregon.



2. *Najas gracillima* Magnus  
 Abundant in ponds, lakes, and quiet waters throughout North Carolina except for the southern half of the Piedmont and Coastal Plain provinces. Extending northward into Maine and westward into Minnesota and Missouri.



3. *Najas minor* All.  
 Known in North Carolina only from a pond in Wake County. This is an introduced species which has become established in localized areas scattered throughout the United States.

--JUNCAGINACEAE--

1. TRIGLOCHIN: Arrow-grass

Emergent plants of brackish marshes producing stolons from which arise tufted erect stems and subterete, hollow, sheathing, basal leaves. Flowers (each "flower" is more properly termed an inflorescence) are short-stalked on an elongate axis. The carpels are attached to a central floral axis from which the fertile carpels separate, from the base upward, at maturity.

1. *Triglochin striata* R. & P.  
 Locally abundant in brackish marshes of the outer Coastal Plain of North Carolina. Extending northward, along the coast, into Maryland and southward, along the coast, into Florida and the Gulf states; Oregon and California.





# ZANNICHELLIA

# NAJAS



*Z. palustris*



*N. guadalupensis*



*N. gracillima*



*N. minor*

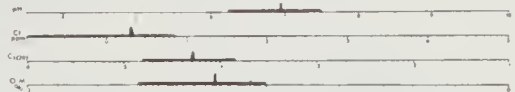
- a. Carpels attached to the receptacle in a ring; flowers all perfect; inflorescence paniculate; leaves never sagittate...1. *Alisma*
- a. Carpels in dense heads; flowers perfect or imperfect; inflorescence racemose or paniculate; leaves with or without basal lobes.
  - b. All flowers of the inflorescence perfect; carpels plump; head of achenes appearing bur-like when mature; inflorescence racemose, weak, and decumbent, often rooting at the nodes; leaves never sagittate.....2. *Echinodorus*
  - b. All of the upper flowers staminate (rarely pistillate), never perfect; carpels flattened; head of achenes smooth; inflorescence racemose to paniculate, erect; leaf blades often sagittate.....3. *Sagittaria*

1. ALISMA: *Water- or Mud-plantain*

Plants of wet soil or shallow water with erect stems and basal, ovate to cordate leaves arising from short, corm-like rootstocks with fibrous roots. The flowers are numerous, in whorls on a paniculate inflorescence which also has whorled branches. Each flower consists of 3 sepals, 3 white to pinkish petals, 6-9 stamens and numerous, separate, laterally-flattened carpels arranged in a ring on a flattened receptacle.

1. *Alisma subcordatum* Raf.

Abundant in wet soil, marshes, ponds, and along streams chiefly in the Piedmont Province of North Carolina. Extending northward into New England, southward into Florida and westward into Minnesota, Nebraska, and Texas. [*A. plantago-aquatica* var. *parviflorum* (Pursh) Farw.]



2. ECHINODORUS: *Bur-head*

Plants of wet soil or shallow water with erect or decumbent stems and basal leaves. In our species the inflorescence consists of a simple or sparingly branched decumbent axis bearing verticels of flowers and rooting at the nodes. Each flower consists of 3 sepals, 3 white petals, 6-many stamens, and few-to-many plump carpels closely packed in a head.

- a. Leaf blade broadly cordate; achenes more than 25 per flower; flowers in several whorls along a simple, decumbent scape which often roots at the nodes.....1. *E. cordifolius*
- a. Leaf blade narrowly elliptic-lanceolate; achenes 20 or less per flower; flowers in a solitary whorl (umbel).....2. *E. parvulus*

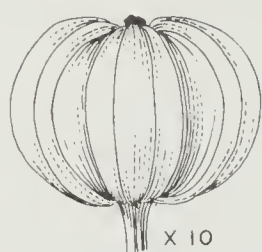
1. *Echinodorus cordifolius* (L.) Griseb.

Abundant in wet soil, marshes, and stream margins in the Coastal Plain Province as well as the Tar and Neuse drainage systems of North Carolina. Extending northward into Virginia, southward into Florida and westward into Kansas, Oklahoma, and Texas. [*E. radicans* (Nutt.) Engelm.]



TRIGLOCHIN

ALISMA



*T. striata*

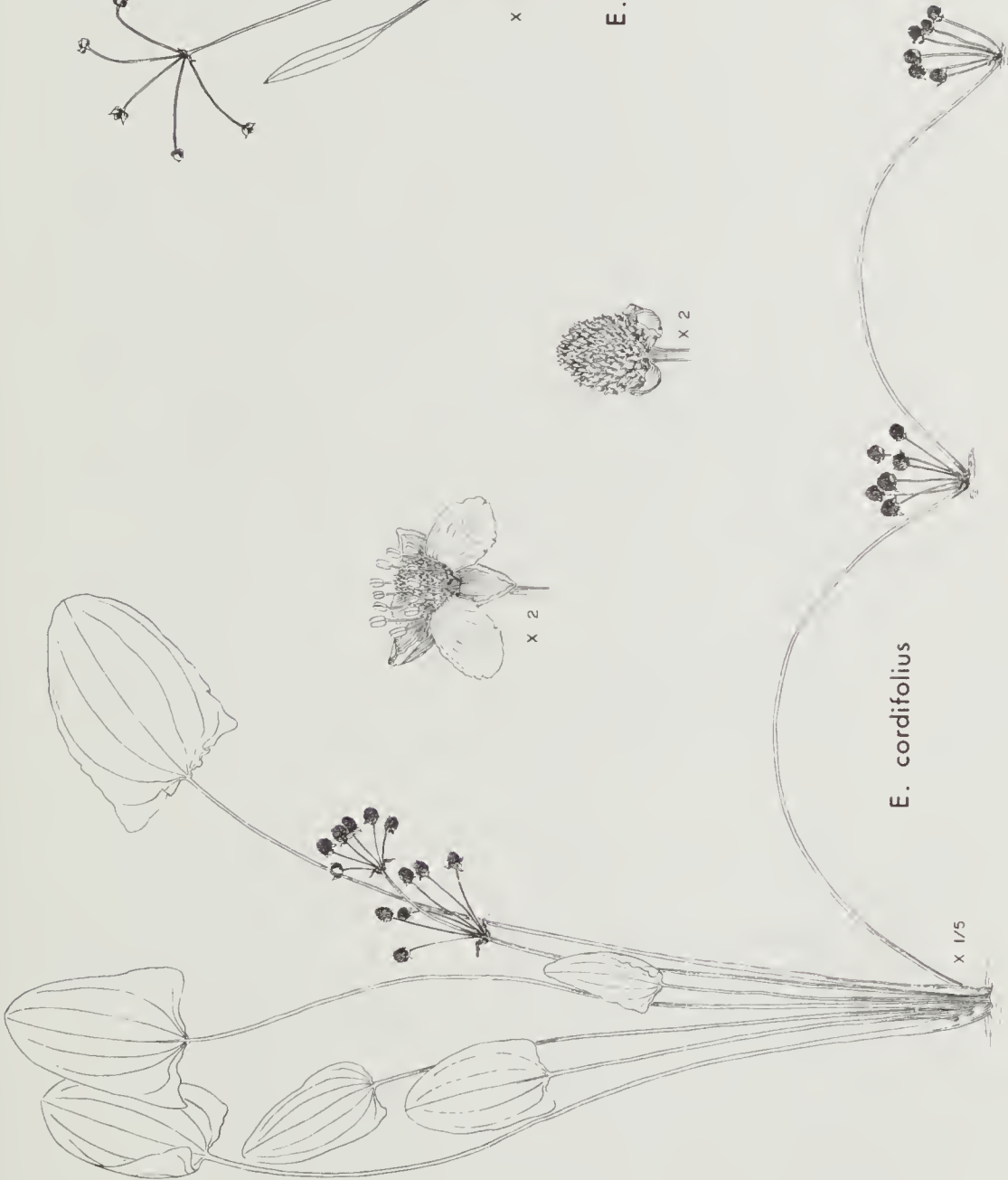
*A. subcordatum*

ECHINODORUS

*E. parvulus*



*E. cordifolius*



2. *Echinodorus parvulus* Engelm.

Not known to occur in North Carolina. However, it does exist in Virginia and South Carolina. Thus, it might be expected to occur in North Carolina also. If so, the shallow sandy sinks in the southeastern portion of North Carolina would seem to provide the most appropriate habitat. Extending, very locally, northward into Massachusetts, southward into Florida and westward into Minnesota, Missouri, and Texas. [*E. tenellus* var. *parvulus* (Engelm.) Fassett, *Helianthium parvulum* (Engelm.) Small]

3. SAGITTARIA: Arrow-head, Swamp- or Duck-potato

Plants of wet soil or emersed to submersed in fresh to brackish water, with basal leaves and flowers in whorls of 3 borne on a leafless stem, the male flowers above, the female below. Many species produce stolons, some of which bear tubers at the apex. The leaves of some species produce expanded sagittate blades. Other species exhibit leaves of a lobed or unlobed nature on the same plant. Still other species produce leaves that lack lobes entirely, often producing leaves reduced to bladeless flattened petioles (phyllodia).

Each flower consists of 3 sepals, 3 petals, and either numerous stamens or numerous flattened carpels densely compacted into a head (in some species the fertile flowers also produce functional or sterile stamens).

Morphological variability in *Sagittaria* is extensive but, at least in the species studied experimentally by Wooten (1973), that variability appears to be genetically based with specific morphological forms being habitat specific. Additional experimental studies of the type initiated by Wooten are urgently needed in this genus.

The treatment of *Sagittaria* which follows is at considerable variance with that of Bogin (1955), the last monographer of the genus. Rather, the treatment by Beal (1960b) is considered to be more accurate and appropriate. *Sagittaria isoetiformis* J. G. Sm. is considered by Godfrey and Adams (1964) to be a distinct taxon that occurs from Florida to North Carolina. However, an examination of the type collection of *S. isoetiformis* shows that name to have been applied by J. G. Smith (1895) to a narrow-leaved form of *S. graminea* var. *graminea* (not to the North Carolina plants of *S. teres* which Godfrey and Adams misidentified as *S. isoetiformis*). Wooten (1973) confirmed the unity of *S. isoetiformis* and *S. graminea* through an experimental approach involving hybridization studies.

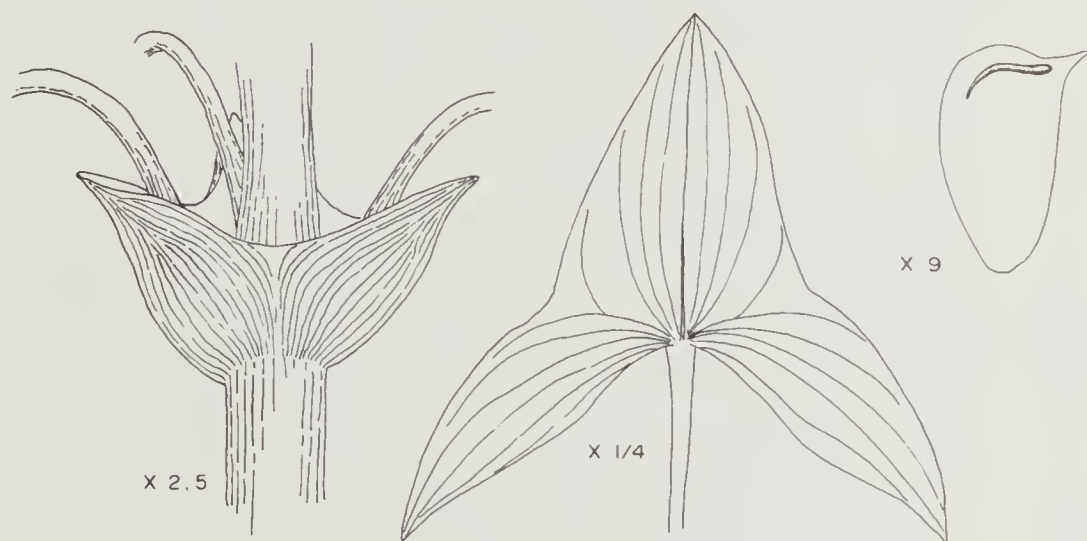
- a. Pedicels of lowest whorl of flowers recurved in fruit.
- b. Sepals of fertile flowers closely appressed in fruit; leaves sagittate or reduced to spongy phyllodia.
- c. Fertile flowers perfect; petals all white.....1. *S. calycina*
- c. Fertile flowers without functional stamens; petals white with purple spot at base.....2. *S. montevidensis*
- b. Sepals of fertile flowers spreading or recurved in fruit; leaves ovate, linear or reduced to phyllodia, rarely with basal lobes.
- d. Filaments glabrous; bracts connate at base; leaves represented by linear phyllodia, the floating ends occasionally with lanceolate to ovate blades.
- e. Plant usually dwarf, on mud or in shallow water; phyllodia linear, up to 30 cm long.....
- .....3a. *S. subulata* var. *subulata*



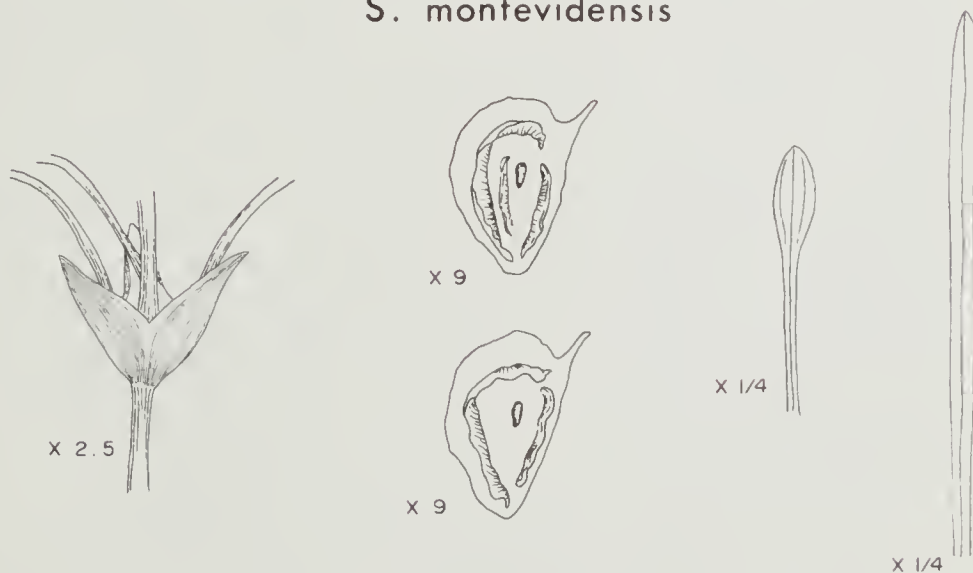
# SAGITTARIA



## *S. calycina*



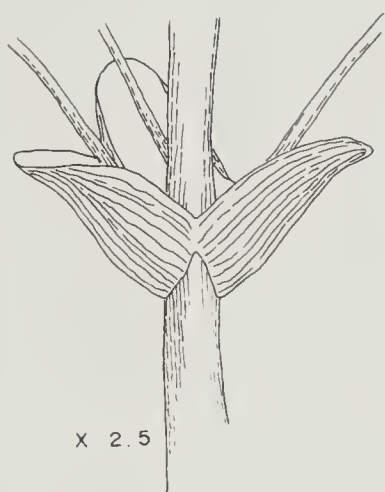
## *S. montevidensis*



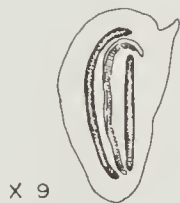
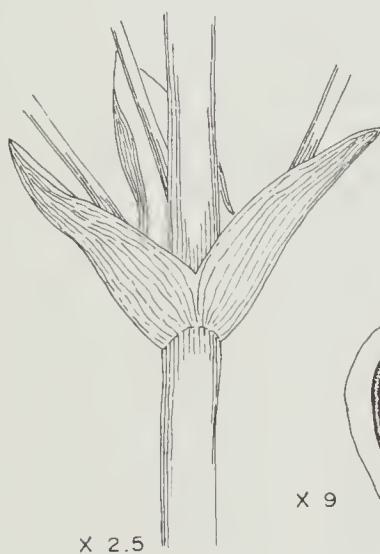
## *S. subulata*

- e. Plant elongate, in deep and flowing water; phyllodia linear, more than 30 cm long.....3b. *S. subulata* var. *gracillima*
- d. Filaments pubescent; bracts strongly connate; leaves emersed and broadly to narrowly ovate, the blade rarely with basal lobes.....4c. *S. graminea* var. *platyphylla*
- a. Pedicel of lowest whorl of flowers divergent or ascending in fruit.
- f. Blades of mature leaves typically linear to ovate, without basal lobes, or reduced to terete phyllodia; filaments pubescent.
- g. Filaments dilated at base, about equalling or shorter than the anthers; bracts more-or-less connate, membranous; leaf blades membranous.
- h. Achenes with one median resin-duct over the embryonic surface and a posterior, crescent-shaped resin-duct at the base of the dorsal keel, rarely with an anterior resin-duct.
- i. Median resin-duct large and club-shaped, twice the diameter of the posterior duct; pedicels of mature pistillate flowers 1-3.5 cm long; phyllodia 1 cm or less in width, linear to lanceolate, with acute apices.....4a. *S. graminea* var. *graminea*
- i. Median resin-duct linear, about the same diameter as posterior duct, or ducts absent; pedicels of mature pistillate flowers usually at least 4 cm long; phyllodia more than 1 cm wide, linear with rounded and obtuse apices.....4b. *S. graminea* var. *weatherbiana*
- h. Achene with multiple median resin-ducts, a posterior resin-duct and, commonly, an anterior resin-duct.
- j. Blades of the emersed leaves broad and spatulate; phyllodia flat; median resin-ducts compact, exhibiting a convoluted surface on mature achene...5. *S. fasciculata*
- j. Blades of emersed leaves not present, all leaves reduced to spongy phyllodia, terete and gradually tapering; median resin-ducts distinct, often separated by lateral wings.....6. *S. teres*
- g. Filaments linear, much longer than the anthers; bracts united at base only, thickened; leaf blades coriaceous; bracts and sepals papillose.....7. *S. falcata*
- f. Blades of the mature leaves usually with basal lobes; filaments glabrous.
- k. Bracts thin and papery, obtuse; beak of mature achene projecting at right angle from body.
- l. Plant pubescent.....8a. *S. latifolia* var. *pubescens*
- l. Plant completely glabrous.
- m. Body of leaf blade variable in width, acute at apex.....8b. *S. latifolia* var. *latifolia*
- m. Body of leaf blade consistently broadly oval, obtuse at apex.....8c. *S. latifolia* var. *obtusata*
- k. Bracts firm, acuminate; beak of mature achene ascending to erect and arched.
- n. Lateral wing of mature achene extending into beak; resin-ducts present; pistillate flowers confined to lower two whorls; pedicels thick; bracts shorter than pedicels; body of leaf blade lanceolate to narrowly elliptic.....9. *S. engelmanniana*

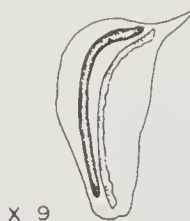
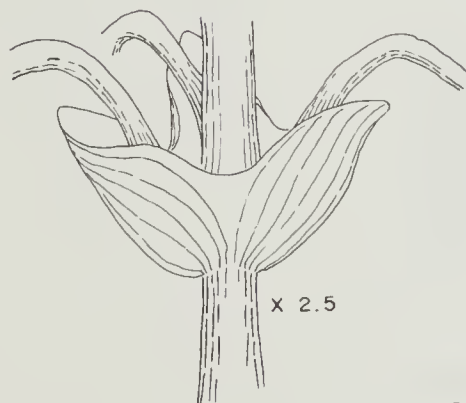
# SAGITTARIA



var. *graminea*



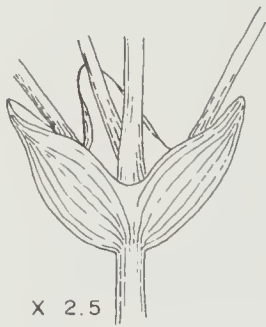
var. *weatherbiana*



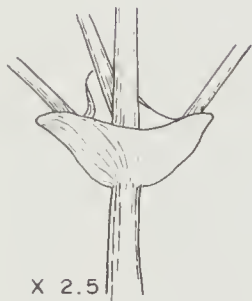
var. *platyphylla*

*S. graminea*

# SAGITTARIA

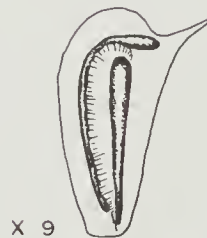
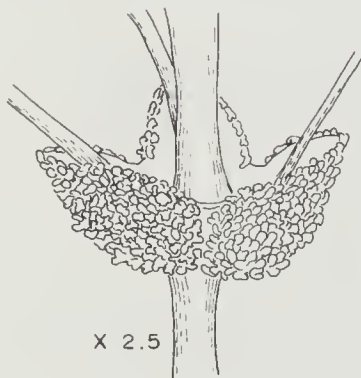


## S. fasciculata



## S. teres

X 1/4

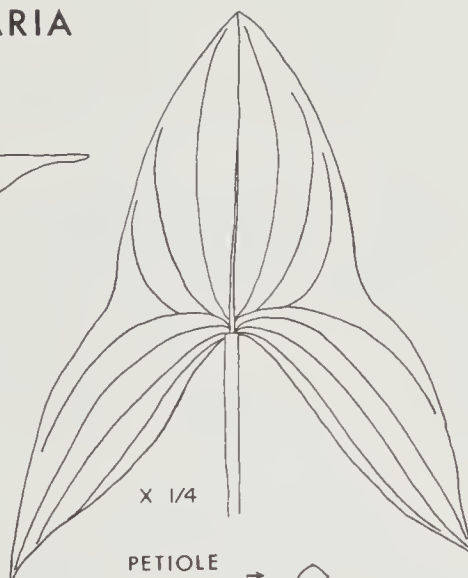
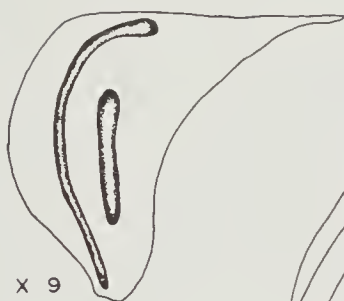


## S. falcata

X 1/4



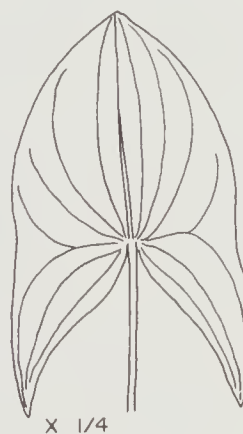
# SAGITTARIA



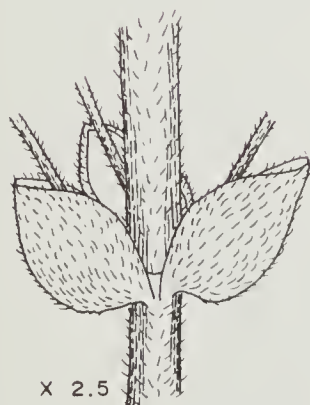
var. latifolia

PETIOLE  
X SECT. →  X 1/2

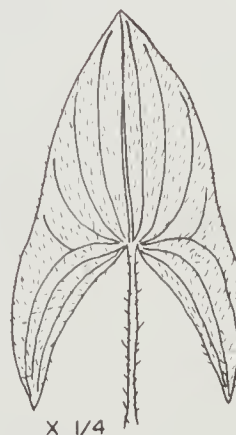
## S. latifolia



var. obtusa



var. pubescens





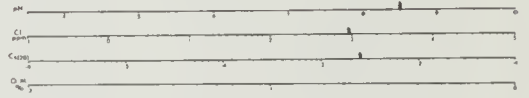
- n. Lateral wing of mature achene confined to surface of fruit above embryo, ending abruptly, not confluent with beak; resin-ducts absent; pistillate flowers more numerous; pedicels filiform, bracts about as long as or exceeding the pedicels; body of leaf blade narrowly elliptic to ovate.....10. *S. longirostra*

1. *Sagittaria calycina* Engelm.

The North Carolina plants, known as var. *spongiosa* Engelm., occur only in Orange and Hyde counties. Extending, along the Atlantic coastal states,

northward into Maine and widely distributed in the Mississippi Valley states; Texas, New Mexico, Arizona, California, and Oregon.

[*Lophotocarpus calycinus* (Engelm.) J. G. Sm., *S. montevidensis* of most Am. authors, not Cham. & Schl.]



2. *Sagittaria montevidensis* Cham. & Schl., Giant Arrowleaf

Known in North Carolina only from a collection made by G. McCarthy at Wilmington, New Hanover County in 1888. The only collection of this plant from North Carolina probably represents a temporary introduction. However, a similar introduction apparently also occurred in South Carolina where a large population still exists along the Savannah River near Savannah. Perhaps this species also still exists in the marshes along the Cape Fear River near Wilmington.

3. *Sagittaria subulata* (L.) Buch.

Infrequent and usually submersed in streams with tidal influence in the outer Coastal Plain of North Carolina. Extending northward, along the Atlantic Coast states, into Massachusetts and southward, along the Atlantic Coast and Gulf states, into Mississippi.



a. var. *subulata*

Throughout the outer Coastal Plain of North Carolina.

b. var. *gracillima* (Wats.) J. G. Sm.

Known in North Carolina only from Long Creek, Pender County.

4. *Sagittaria graminea* Michx.

a. var. *graminea*

Common in shallow, fresh or brackish marshes and pond margins throughout the Coastal Plain but chiefly in the outer Coastal Plain of North Carolina.



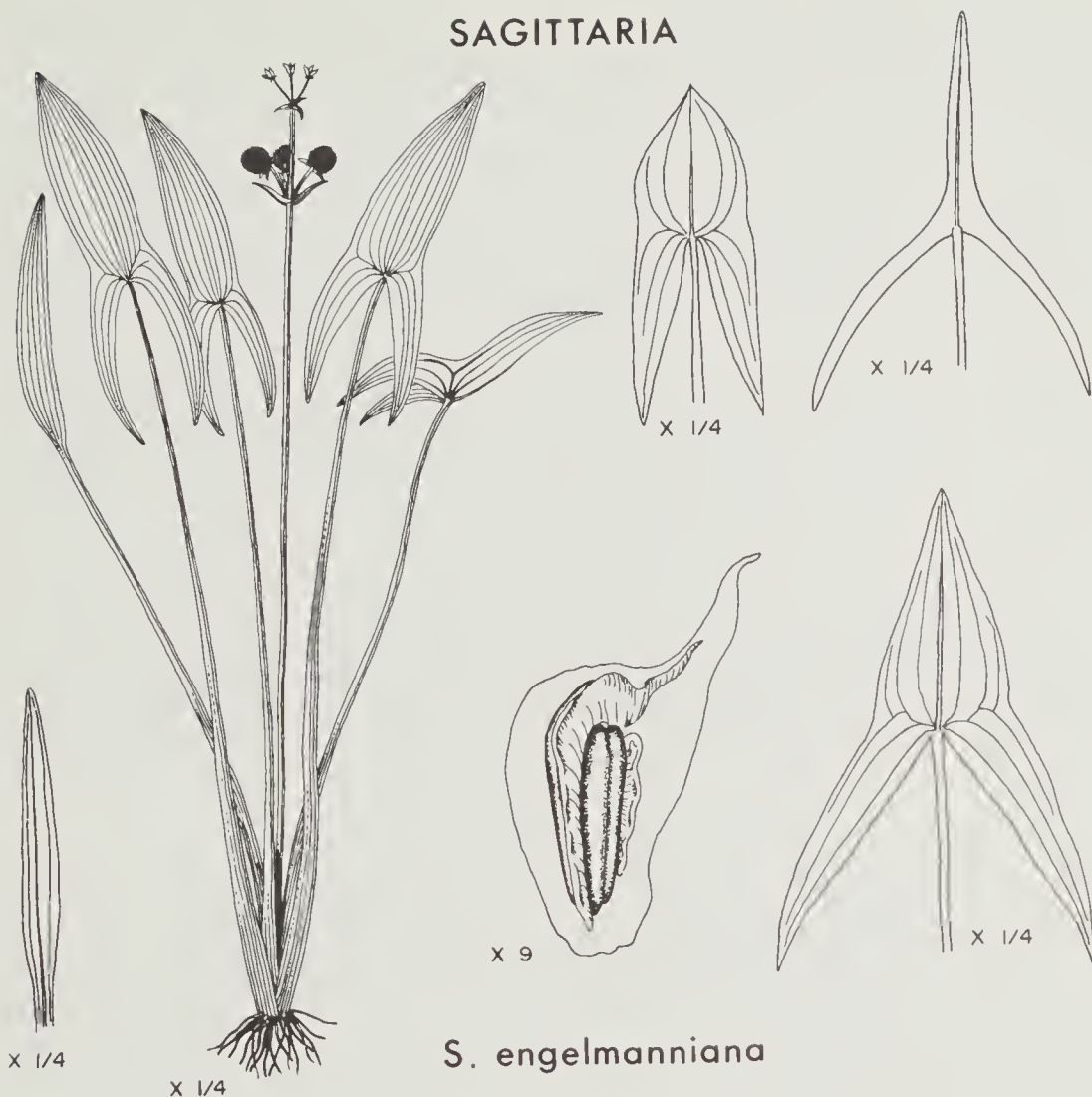
Extending northward into Maine, southward into Florida and westward into Minnesota, Iowa, Nebraska, Oklahoma, and Texas. [Includes *S. isoetiformis* J. G. Sm.]

b. var. *weatherbiana* (Fern.) Bogin

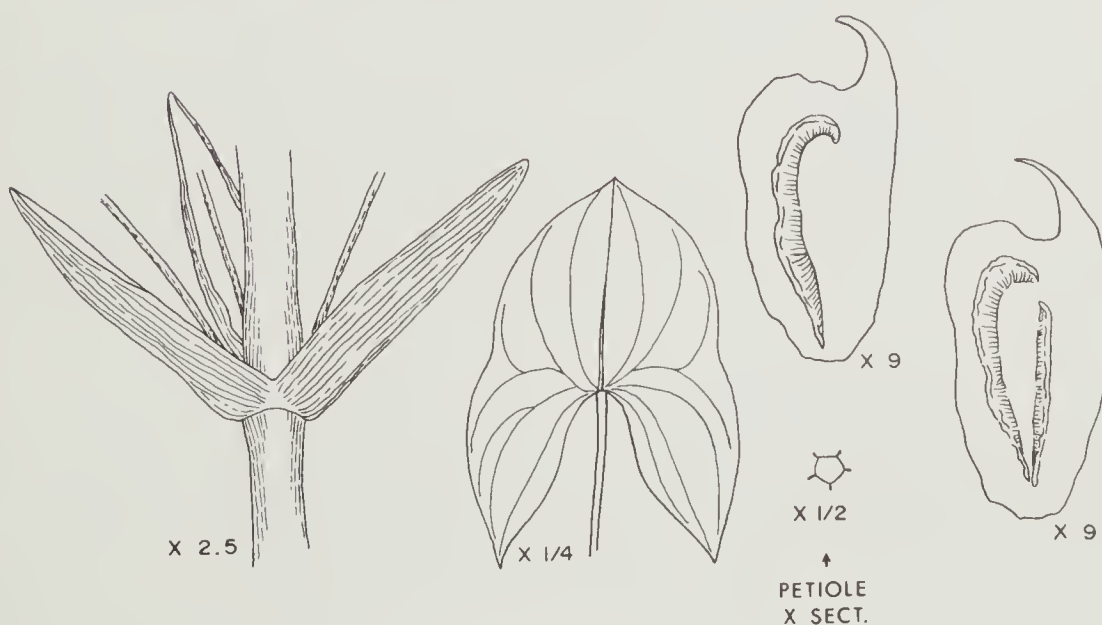
Common in fresh to slightly brackish streams and swamps in the Coastal Plain, chiefly the outer half of the Coastal Plain, of North Carolina. Extending northward into Virginia and southward into South Carolina (and possibly Florida).



# SAGITTARIA



*S. engelmanniana*



*S. longirostra*

c. var. *platyphylla* Engelm.

Known in North Carolina only from a farm pond in Union County where it has been introduced. Also introduced into South Carolina. Extending from Kentucky to Kansas and southward into the Gulf states.

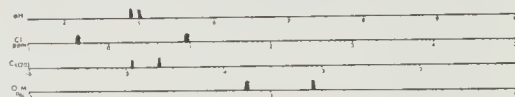


5. *Sagittaria fasciculata* E. O. Beal

Known only from swamps and bogs in Buncombe and Henderson counties, North Carolina and in Greenville County, South Carolina. This taxon is slightly cross-fertile with *S. graminea* (Wooten, 1973).

6. *Sagittaria teres* Wats.

Locally abundant in acidic sandy ponds in the extreme southern portion of the Coastal Plain of North Carolina. Extending northward into Massachusetts and southward into South Carolina.



7. *Sagittaria falcata* Pursh

Abundant in tidal marshes in the outer Coastal Plain of North Carolina. Extending northward, along the Atlantic coast, into Maryland and southward into Florida and Texas.



8. *Sagittaria latifolia* Willd., Duck-potato, Wapato

Abundant on wet ground, in marshes, and along streams and pond margins throughout North Carolina except in the extreme northeastern counties, most of the counties in the Tar River basin, and the Sand Hills area. Extending throughout the United States. Distributional and water analysis data indicate that the three following varieties probably do not warrant formal recognition.



a. var. *pubescens* (Muhl.) J. G. Sm.

Widely distributed but most abundant in the Blue Ridge Province of North Carolina; common.

b. var. *latifolia*

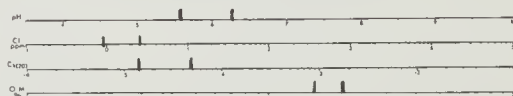
Chiefly in the northern portion of the Coastal Plain of North Carolina; infrequent.

c. var. *obtusa* (Muhl. ex Willd.) Wieg.

Chiefly in acidic marshes and ponds in the Coastal Plain of North Carolina; infrequent.

9. *Sagittaria engelmanniana* J. G. Sm.

Locally abundant in acidic waters of marshes and along acidic pond and stream margins in the Piedmont and Coastal Plain provinces, but most abundant in the Sand Hills area, of North Carolina. Extending northward into Massachusetts and southward into South Carolina.



10. *Sagittaria longirostra* (Michx.) J. G. Sm.

Abundant in wet soil, marshes, and along pond and stream margins throughout the Piedmont and northern half of the inner Coastal Plain of North Carolina.

Extending northward into New Jersey and Pennsylvania, southward into Florida and westward into Indiana, Missouri, and the Gulf states.

[*S. australis* (J. G. Sm.) Small; *S. engelmanniana* ssp. *longirostra* (Michx.) Bogin]



--HYDROCHARITACEAE--

- a. Leaves cauline, opposite or whorled.
  - b. Upper leaves in whorls of 4 or more; principal leaves 1.2-4.0 cm long.....1. *Egeria*
  - b. Upper leaves in whorls of 3; principal leaves 0.6-1.7 cm long.....2. *Elodea*
- a. Leaves basal or essentially so.
  - c. Blades of leaves differentiated from petiole, broadly ovate to cordate.....3. *Limnobium*
  - c. Blades of leaves ribbon-like, elongate.
    - d. Plant of freshwater areas; leaf with a broad band of lacunae along each side of the midrib, tip entire.....4. *Vallisneria*
    - d. Plant of saltwater areas; leaf without distinctive lacunar band, tip finely serrate.....5. *Thalassia*

1. EGERIA: *Water-weed, Anacharis*

Submersed plants of freshwater areas with lax stems rooted or broken loose and free-floating. Leaves linear, minutely serrate, at least the upper in whorls of 4 or more. The male flowers are borne in sessile spathes from the upper leaf axils and projected to the water surface by elongation of the hypanthium. Female flowers have not been observed in the specimens from North Carolina.

1. *Egeria densa* Planch.

Locally abundant in ponds and sluggish streams chiefly in the Coastal Plain of North Carolina.

Extending northward into New England, southward into Florida and westward into Kentucky and Mississippi; Texas, Oklahoma, Arizona, and California. Introduced but well established through vegetative reproduction. [*Elodea densa* (Planch.) Casp., *Anacharis densa* (Planch.) Vict.]



2. ELODEA: *Water-weed, Anacharis*

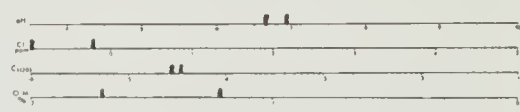
Submersed plants of freshwater areas with lax stems rooted or broken loose and free-floating. Leaves linear, minutely toothed along the margins, in whorls of 3. The male flowers are borne in sessile to stalked axillary spathes and reach the water surface either through elongation of the hypanthium (*E. canadensis*) or by breaking free and floating to the surface (*E. nuttallii*). Female flowers are borne in spathes and reach the water surface by elongation of the hypanthium in both species.



- a. Leaves elliptical to oblong, blunt, usually densely imbricated at the growing stem tips, mostly 1-5 mm wide; male flowers borne in stalked, axillary spathes and not liberated; female spathes broadest toward the apex.....1. *E. canadensis*
- a. Leaves linear, pointed at the tip, not densely imbricated at the growing stem tips; male flowers borne in sessile spathes and liberated to float free; female spathes narrowed toward the apex.....2. *E. nuttallii*

1. *Elodea canadensis* Michx.

Infrequent in lakes and streams in all provinces of North Carolina. Extending northward into New England, southward into Alabama and westward into North Dakota, Iowa, Oklahoma, and Texas; western states except for Arizona and New Mexico. [*Anacharis canadensis* (Michx.) Rich.]



2. *Elodea nuttallii* (Planch.) St. John

Locally abundant in ponds and sluggish streams chiefly in the Blue Ridge and Coastal Plain provinces of North Carolina. Extending northward into Maine, southward into Mississippi and westward into Idaho, Wyoming, Colorado, New Mexico, and Oklahoma. [*Anacharis nuttallii* Planch.; *A. occidentalis* (Pursh) Vict.]



3. LIMNOBIUM: American Frog's-bit

Floating plants (or stranded on mud) of freshwater areas with long-petioled basal leaves the blades of which are reniform to ovate in outline as well as usually spongy and purplish on the back. Male flowers are borne, in groups of 3 or more, on an elongate axis arising from a spathe. Female flowers are borne solitary or in pairs, on a short, stout axis which becomes elongated and recurved in fruit.

1. *Limnobium spongia* (Bosc.) Steud.

Locally abundant in acidic marshes and shallow stagnant ponds in the outer Coastal Plain of North Carolina. Extending northward into Virginia, southward, along the Atlantic and Gulf coasts, into Texas and inland, along the Mississippi River, into southern Illinois.



4. VALLISNERIA: Tapegrass, Eelgrass

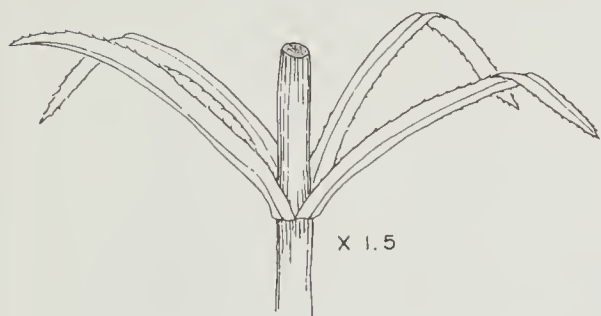
Submersed plants of freshwater areas producing rosettes of linear-elongate leaves at the nodes of slender stolons. The leaves are minutely serrulate, especially toward the tip, and possess a characteristic central band of lacunae. Numerous male flowers are released from each short-stalked spathe and float freely on the water surface. Female flowers are also borne in spathes (one per spathe) but reach the water surface through peduncle elongation. After fertilization, the peduncle coils drawing the fruit underwater.



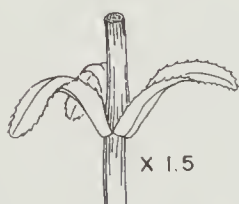
EGERIA

ELODEA

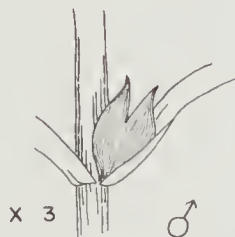
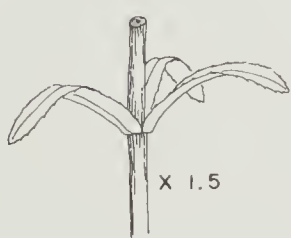
LIMNOBIUM



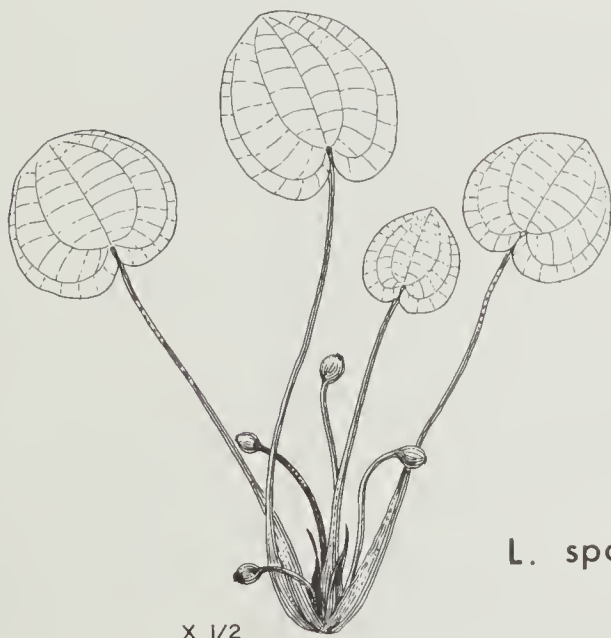
*Eg. densa*



*El. canadensis*



*El. nuttallii*

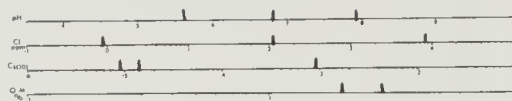


*L. sponsia*



1. *Vallisneria americana* Michx.

Infrequent in lakes, streams, and sounds in the Coastal Plain of North Carolina. Extending throughout the eastern half of the United States from North Dakota and Texas.



5. THALASSIA: *Turtle-grass*

1. *Thalassia testudinum* Konig

This marine plant is not, as far as is known, a native of our coastal waters but is included since a specimen has been washed ashore on Bogue Beach in Craven County. Its native habitat is in shallow, marine areas from peninsular Florida to Texas and south to northern South America.

--POACEAE (GRAMINEAE)--

Among the many genera and species of grasses only a few are plants of marshes or aquatic areas. Those that are herein referred to as "aquatic" possess few, if any, morphological adaptations to the aquatic habitat.

Some species produce fibrous roots while others are strongly rhizomatous. Some grow in freshwater while others are limited to brackish or saline conditions. All possess the typical grass characteristics of 1) a narrow, parallel-veined leaf composed of blade and sheath with, usually, a ligule at the juncture, and 2) a spikelet consisting of two glumes subtending one or more florets (or some reduction thereof) as the ultimate inflorescence.

In all of the grasses herein considered aquatic, except for most species of *Glyceria*, the leaf sheath encloses the stem but is open. The Cyperaceae, which are superficially similar to the Poaceae, possess closed leaf sheaths. Additional characteristics which are typical of, but not universally applicable to, plants of these two easily confused families are:

Poaceae

Stem usually cylindric  
Internodes usually hollow  
Leaves usually flat  
Leaves usually 2-ranked  
Stigmas 2  
Anthers flexible  
Pericarp fused to seed

Cyperaceae

Stem usually triangular  
Internodes usually solid  
Leaves usually channeled  
Leaves usually 3-ranked  
Stigmas 2-3  
Anthers attached basally  
Pericarp not fused to seed

- a. Plants low, mat-like, creeping on the shore or floating on the water; leaves less than 6 cm long.
- b. Ligule ciliate; spikelets usually present, bisexual, laterally compressed, many-flowered; lemmas strongly keeled, 3-nerved..
  - .....1. *Eragrostis*
- b. Ligule not ciliate; spikelets (often not present) 1-flowered, unisexual; lemmas not strongly keeled, many-nerved....2. *Hydrochloa*
- a. Plants not mat-like and creeping or floating; culms erect or at most, lax; primary leaves longer than 6 cm.

# VALLISNERIA

# THALASSIA



V. americana



T. testudinum

- c. Spikelet with few-to-many fertile flowers.
  - d. Plant robust, up to 4 m tall, with firm leaves and a hard thick culm; panicle large and plumose; rachilla with long silky hairs.....3. *Phragmites*
  - d. Plant much smaller in size (rarely as tall as 2 m) and robustness; rachilla without long silky hairs.
    - e. Leaves firm with closely overlapping sheaths and flat to involute sharp-pointed blades that are conspicuously distichous; culms arising from extensively creeping rhizomes; dioecious; plant of brackish marshes and sea-shores.....4. *Distichlis*
    - e. Leaves foliaceous, borne on a culm with elongated internodes, sheaths seldom overlapping, not conspicuously distichous; not dioecious; plant of fresh-water areas.....5. *Glyceria*
- c. Spikelet bearing only one fertile flower.
  - f. The spikelets laterally imbricated or in irregular clusters on one side of the panicle branches.
    - g. Spikelets laterally flattened; sterile lemma not present.
      - h. Branches of the inflorescence bearing one row of overlapping spikelets; keeled margin of spikelet (palea and lemma) sharp-ciliate; glumes absent.....6. *Leersia*
      - h. Branches of the inflorescence bearing two rows of spikelets (glumes) glabrous to hispid-ciliate.....7. *Spartina*
    - g. Spikelets planoconvex; sterile lemma present below the fertile floret.
      - i. The spikelets (glumes and sterile lemma) with stiff spines, usually long-awned from the sterile lemma.. .....8. *Echinochloa*
      - i. The spikelets without stiff spines; not awned.....9. *Paspalum*
  - f. The spikelets not appearing laterally imbricated.
    - j. Spikelets densely packed in an elongated spike-like terminal panicle that is not obviously branched.. .....10. *Alopecurus*
    - j. Spikelets in an open or appressed panicle with obvious branches.
      - k. Glumes long-awned.....11. *Polypogon*
      - k. Glumes not long-awned.
        - l. Florets with many silky hairs arising from the callus, the hairs at least two-thirds the length of the floret, lemma awned from the back.....12. *Calamagrostis*
        - l. Florets without callus hairs (if basal hairs present, arising from the margins of the two sterile lemmas); lemma not awned or awned from the apex.
          - m. Spikelets bisexual, with at least one sterile lemma; spikelet not terete.
            - n. Sterile lemmas 2, minute, ciliate along the margins.....13. *Phalaris*
            - n. Sterile lemma 1, large, not ciliate.
              - o. Second glume inflated and gibbous at the base.....14. *Sacciolepis*
              - o. Second glume not gibbous.....15. *Panicum*

- m. Spikelets unisexual, with no sterile lemmas and no glumes; pistillate spikelet terete.
- p. Pistillate spikelets on the ascending upper branches, staminate on the spreading lower branches.....16. *Zizana*
- p. Pistillate and staminate spikelets intermixed on the same branches.....17. *Zizaniopsis*

# 1. ERAGROSTIS: Love Grass

Spikelet several-flowered, the glumes shorter than the lemmas. Lemma 3-nerved.

## 1. *Eragrostis hypnoides* (Lam.) BSP.

Infrequent in mud-flats, marshes, and shores of streams and ponds in scattered localities throughout North Carolina. Extending throughout most of the United States.

# 2. HYDROCHLOA

Male spikelets 3-4-flowered, without glumes and paleas, lemmas 7-nerved. Female spikelets 3-4-flowered, without glumes, lemmas and paleas many-nerved. Rooted on shore but floating on water.

## 1. *Hydrochloa caroliniensis* Beauv.

Infrequent in ponds, ditches, lakes, and sluggish streams in the Coastal Plain of North Carolina. Extending southward, along the Atlantic and Gulf coasts, into Florida and Texas.



# 3. PHRAGMITES: Reed

Spikelets several-flowered, the lower male or neutral. First glume about half as long as the second, 3-nerved. Lemmas 3-nerved. Rachilla with silky hairs which, at maturity, are longer than the glumes and lemmas.

## 1. *Phragmites australis* (Cav.) Trin. ex Steud.

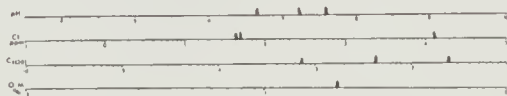
Infrequent in ditches, swamps, marshes, and along pond and stream margins in scattered localities throughout North Carolina. Extending throughout the United States but infrequent in the southeast. [*P. communis* Trin.]

# 4. DISTICHLIS: Salt Grass

Spikelets compressed, few- to many-flowered, with firm glumes. First glume 1-nerved, the 2nd glume 3-5-nerved. Lemmas firm, with 9-11 faint nerves. Palea equaling lemma.

## 1. *Distichlis spicata* (L.) Greene

Common in brackish flats and salt marshes in the outer Coastal Plain of North Carolina. Extending, along the Atlantic and Gulf coasts, from Maine to Texas; Missouri and along the Pacific Coast.





ERAGROSTIS    HYDROCHLOA



## 5. GLYCERIA: Manna Grass

Spikelets few- to many-flowered. Glumes unequal. Lemmas rounded on the back with 5 to 9 nerves. Sheath closed in most species.

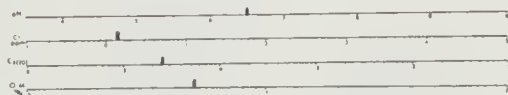
- a. Spikelets long (as much as 1 cm), linear and nearly terete, on short pedicels, appressed; panicles narrow, erect.....1. *G. septentrionalis*
- a. Spikelets short (usually not more than 5 mm long), not linear, ovate to oblong, more-or-less compressed laterally, not appressed; panicles open to contracted and often nodding.
  - b. Panicle contracted, not lax, usually not drooping.
    - c. Lemmas 2 to 2.5 mm long prominently nerved; panicle rather loose, nodding, more than 10 cm long; primarily a mountain species.....2. *G. melicaria*
    - c. Lemmas 3 to 4 mm long, obscurely nerved; panicle oblong, dense, erect, usually not more than 10 cm long; a Coastal Plain species.....3. *G. obtusa*
  - b. Panicle open, lax, usually drooping.
    - d. Leaf sheath open; second glume 3-nerved; culm decumbent, weak; panicle pale green.....4. *G. pallida*
    - d. Leaf sheath closed; second glume 1-nerved; culm erect, stout at least at the base; panicle not pale green.
      - e. Spikelets small, 3 to 4 mm long; nerves of lemma very prominent; plants rather slender.....5. *G. striata*
      - e. Spikelets 4.5 to 6 mm long; nerves of lemma not very prominent; plants robust.
        - f. Palea broad, the sides extending conspicuously beyond the lemma, strongly bowed out; the lowest lemmas not over 2.5 mm long; spikelets plump.....6. *G. canadensis*
        - f. Palea narrower, the sides not extending conspicuously beyond the lemma, not strongly bowed out, much shorter than the lemma; the lowest lemmas over 2.5 mm long; spikelets not plump.....7. *G. nubigena*

### 1. *Glyceria septentrionalis* Hitch.

Frequent in low ground, ditches, swamps, and marshes throughout North Carolina. Extending throughout the eastern half of the United States except in Florida.

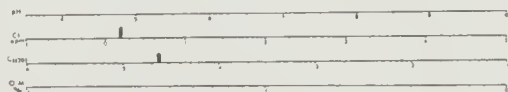
### 2. *Glyceria melicaria* (Michx.) Hubb.

Frequent in low ground, ditches seepage areas, and bogs chiefly in the Blue Ridge Province of North Carolina. Extending northward into Maine and westward into Ohio, Kentucky, and Tennessee.



### 3. *Glyceria obtusa* (Muhl.) Trin.

Frequent in low ground and bogs chiefly in the Sand Hills portion of the Coastal Plain of North Carolina. Extending northward into New York, Vermont, New Hampshire, and Maine.



PHRAGMITES

DISTICHLIS

GLYCERIA



*P. australis*



*D. spicata*



*G. septentrionalis*



*G. melicaria*

# GLYCERIA



*G. obtusa*



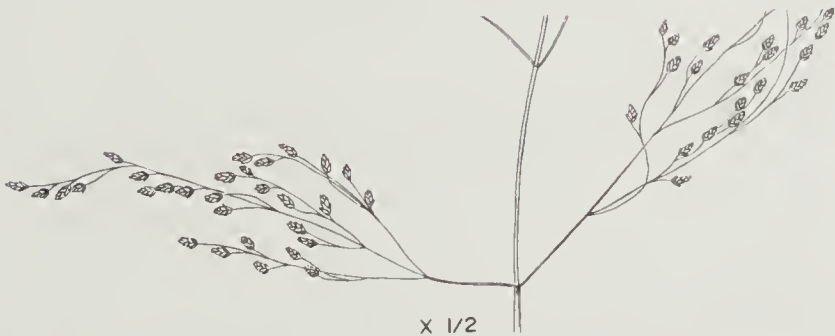
*G. pallida*



*G. striata*



*G. canadensis*



*G. nubigena*



4. *Glyceria pallida* (Torr.) Trin.

Rare in bogs in Avery, Columbus, and Duplin counties of North Carolina. Extending northward into Maine and westward into Wisconsin, southeastern Missouri, and Tennessee.

5. *Glyceria striata* (Lam.) Hitch.

Common in low ground, seepage areas, ditches, marshes, and along stream and pond margins throughout North Carolina. Extending throughout the United States.



6. *Glyceria canadensis* var. *laxa* (Scrib.) Hitch.

Rare in bogs in the Blue Ridge Province of North Carolina. Extending northward into Maine and westward into Minnesota, Wisconsin, and Illinois.

7. *Glyceria nubigena* W. A. Anders.

Rare in seepage areas in Swain County of North Carolina. Extending westward into eastern Tennessee.

6. LEERSIA: *Cutgrass*

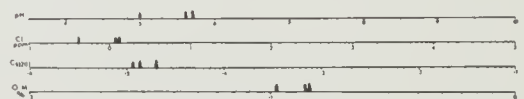
Spikelets 1-flowered, strongly compressed laterally, without glumes. Lemma with 3-5 nerves, paleas usually 3-nerved.

- a. Branches of panicle ascending to appressed; stamens 6;  
ligule 2 or more mm long.....1. *L. hexandra*
- a. Branches of panicle spreading; stamens 3; ligule less than  
2 mm long.
- b. Spikelets broadly oval, 3-4 mm wide.....2. *L. lenticularis*
- b. Spikelets elliptic, not more than 2 mm wide.
- c. Lower panicle branches (at least some) whorled;  
spikelets closely overlapping, 5 mm long.....3. *L. oryzoides*
- c. Lower panicle branches solitary; spikelets loosely  
overlapping, 3 mm long.....4. *L. virginica*

1. *Leersia hexandra* Swartz

Infrequent in ditches, marshes, and ponds in the Sand Hills as well as the southeastern and northeastern portions of the Coastal Plain of North Carolina.

Extending throughout the eastern half of the United States.



2. *Leersia lenticularis* Michx.

Rare in low ground, swamps, and along stream banks in the Coastal Plain Province of North Carolina. Extending northward into Maryland, southward into Florida and westward into Ohio, Indiana, Wisconsin, and Texas.

3. *Leersia oryzoides* (L.) Swartz

Common in low ground, ditches, marshes, and along stream banks throughout North Carolina. Extending throughout the United States.



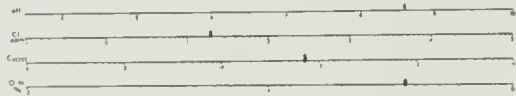


LEERSIA



4. *Leersia virginica* Willd.

Common in low ground, ditches, and marshes throughout North Carolina. Extending throughout the eastern half of the United States.



7. SPARTINA: Cord- or Marsh-grass

Spikelets crowded on one side of the inflorescence axis, 1-flowered, laterally flattened. First glume 1-nerved, second glume 1-7-nerved. Lemmas 1-nerved, exceeded by the paleas.

- a. Margins of leaves glabrous to minutely scabrous.
  - b. Leaf blades less than 3 mm wide; inflorescence branches appressed to spreading, 2-5 cm long, remote on the axis.....1. *S. patens*
  - b. Leaf blades more than 4 mm wide; inflorescence branches appressed, 5-15 cm long, overlapping.....2. *S. alterniflora*
- a. Margins of leaves strongly scabrous.
  - c. First glume as long as or longer than the floret; second glume awned; grass of inland areas.....3. *S. pectinata*
  - c. First glume shorter than the floret, second glume not awned; grass of coastal areas.....4. *S. cynosuroides*

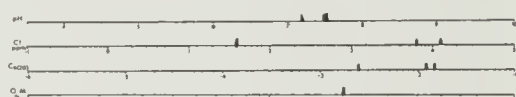
1. *Spartina patens* (Ait.) Muhl., Salt-meadow Grass

Common in brackish sandy swales and salt marshes in the outer Coastal Plain of North Carolina. Extending, along the Atlantic and Gulf coasts, from Maine to Texas; interior in New York and Michigan.



2. *Spartina alterniflora* Loisel., Salt-water Cord Grass

Frequent in brackish and salt marshes in the outer Coastal Plain of North Carolina. Extending, along the Atlantic and Gulf coasts, from Maine to Texas.



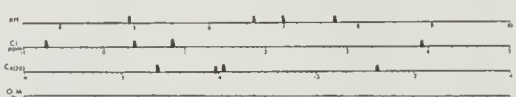
3. *Spartina pectinata* Link, Slough Grass, Fresh-water Cord Grass

Rare in low ground, swamps, marshes, and shallow water in Alleghany, Ashe, Chowan, Mitchell, Montgomery, and Transylvania counties of North Carolina. Extending northward into Maine, southward into Georgia and westward into Washington, Oregon, Utah, New Mexico, Texas, Missouri, and Kentucky.



4. *Spartina cynosuroides* (L.) Roth, Salt Reed-grass

Frequent in fresh to brackish tidal marshes in the outer Coastal Plain of North Carolina. Extending, along the Atlantic and Gulf coasts, from Massachusetts to Texas.



# SPARTINA



*S. patens*



*S. alterniflora*

X 1/4



*S. pectinata*



*S. cynosuroides*

## 8. ECHINOCHLOA

Spikelets crowded on one side of the inflorescence branches. First glume 3-nerved, second glume, usually 5-nerved. Sterile lemmas mostly 7-nerved and awned. Glumes and sterile lemma with stiff hairs. Fertile lemma and palea hard, nerveless.

- a. Fertile lemma elliptic; lower leaf sheaths hispid or scabrous, at least on the margins; spikelets long-awned; spines on nerves of spikelet scales not tuberculate.....1. *E. walteri*
- a. Fertile lemma oval to ovate; leaf sheaths glabrous; spikelets variously awned; spines on nerves of spikelet scales often tuberculate.....2. *E. crusgalli*

### 1. *Echinochloa walteri* (Pursh) Heller

Frequent in swales, shallow water, and fresh or brackish marshes in the outer Coastal Plain of North Carolina. Extending throughout the eastern half of the United States except in the extreme northeast.



### 2. *Echinochloa crusgalli* (L.) Beauv., Barnyard-grass

Common in low ground, ditches, pond margins, and marshes throughout North Carolina. Extending throughout the United States as a weed.



## 9. PASPALUM

Spikelets on one side of the inflorescence branches. First glume (and sometimes the second) absent. Sterile lemma present, basal. Fertile lemma and palea hard.

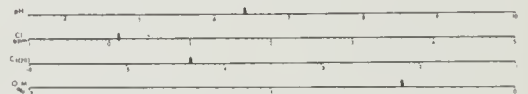
- a. Rachis foliaceous, the winged margins at least as wide as the row of spikelets.
  - b. Rachis extending beyond uppermost spikelet.....1. *P. fluitans*
  - b. Rachis exceeded by uppermost spikelet.....2. *P. dissectum*
- a. Rachis not foliaceous, not winged, more narrow than the spikelets.
  - c. Second glume pubescent.....3. *P. distichum*
  - c. Second glume glabrous.....4. *P. vaginatum*

### 1. *Paspalum fluitans* (Ell.) Kunth

Rare in seepage areas, muddy shores, and shallow water of swamps chiefly in the Coastal Plain Province of North Carolina. Extending northward into Virginia, southward into Florida and westward into Indiana, Illinois, Missouri, Oklahoma, and Texas. [*Paspalum repens* Berg.]

### 2. *Paspalum dissectum* L.

Rare in shallow water and muddy shores in Brunswick, Columbus, Mecklenburg, and Pender counties of North Carolina. Extending northward into New Jersey and southward, along the coast, into Florida and Texas, thence northward into Missouri, Illinois, and Tennessee.





# ECHINOCHLOA

# PASPALUM



x 5



x 1



x 1/2

*E. walteri*



x 5



x 5

*E. crusgalli*



x 10



x 1

*P. fluitans*



x 1



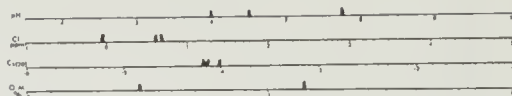
x 10

*P. dissectum*



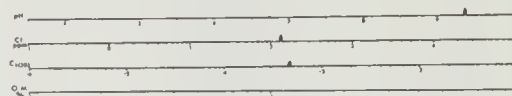
3. *Paspalum distichum* L.

Frequent in low ground, ditches, muddy shores, and fresh to slightly brackish marshes chiefly in the Coastal Plain and Piedmont provinces of North Carolina. Extending northward into New Jersey, southward into Florida and westward, in the southern states, into California, thence northward into Utah, Nevada, Idaho, Oregon, and Washington.



4. *Paspalum vaginatum* Swartz

Rare in brackish marshes chiefly in the outer Coastal Plain of North Carolina. Extending southward, along the Atlantic and Gulf coasts, into Florida and Texas.

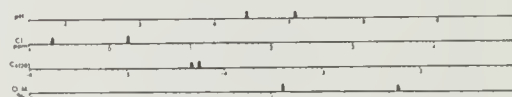


10. ALOPECURUS: *Foxtail*

Spikelets laterally compressed, 1-flowered. Glumes fused at the base. Lemma awned from the back; palea absent.

1. *Alopecurus carolinianus* Walt.

Common in low ground, ditches, and margins of ponds and lakes in the Piedmont and Coastal Plain provinces of North Carolina. Extending northward into New Jersey, southward into Florida and westward into Ohio, Indiana, Wisconsin, Minnesota, and Texas; South Dakota, Montana, and Washington. [*A. ramosus* Poir.]

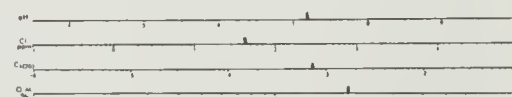


11. POLYPOGON: *Rabbitfoot Grass, Beard Grass*

Spikelets 1-flowered. Glumes about equal, both long-awned.

1. *Polypogon monspeliensis* (L.) Desf.

Frequent in brackish ditches and marshes in the outer Coastal Plain of North Carolina. An introduction from Europe that has become established in coastal areas of the United States.



12. CALAMAGROSTIS: *Reed Grass*

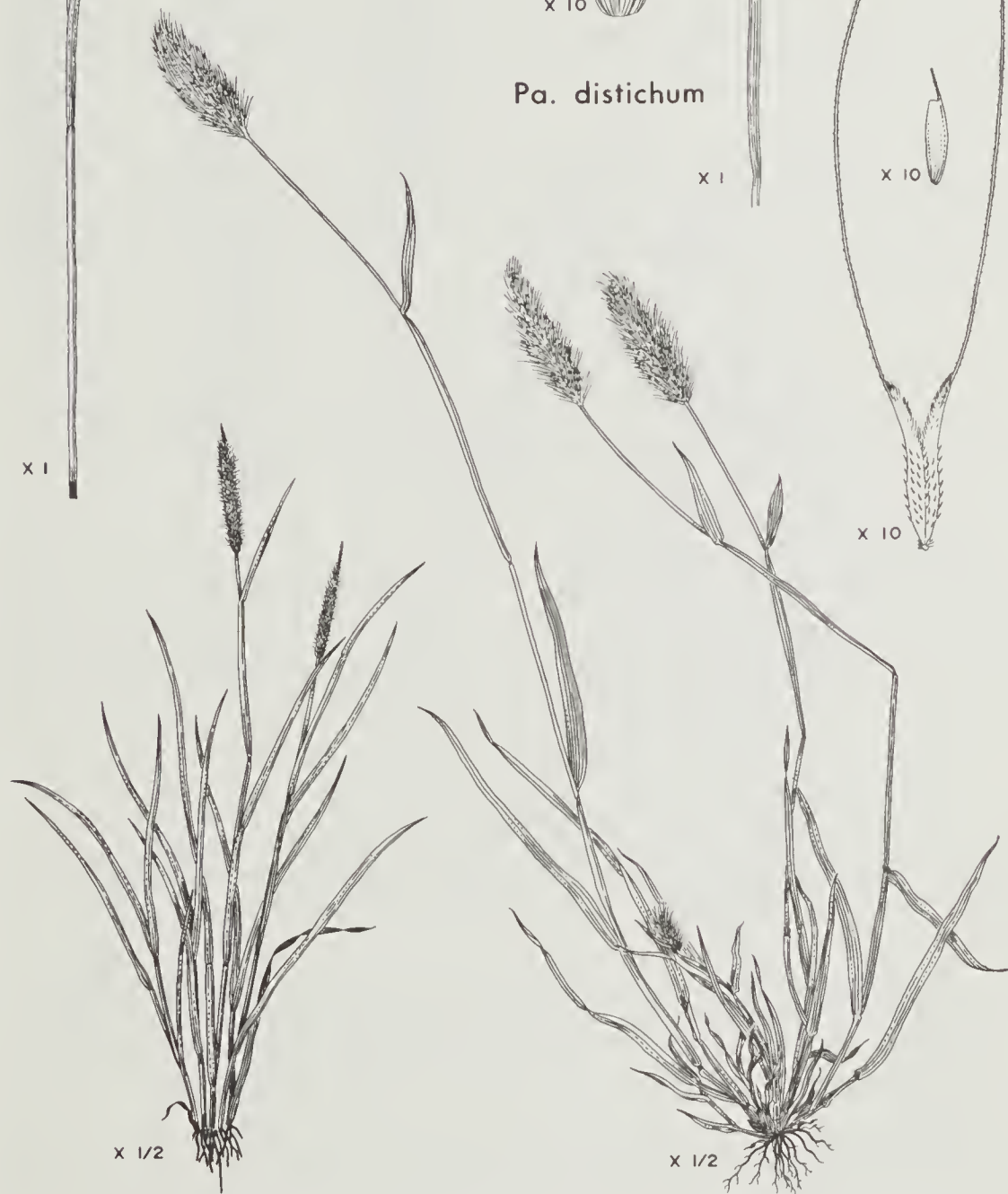
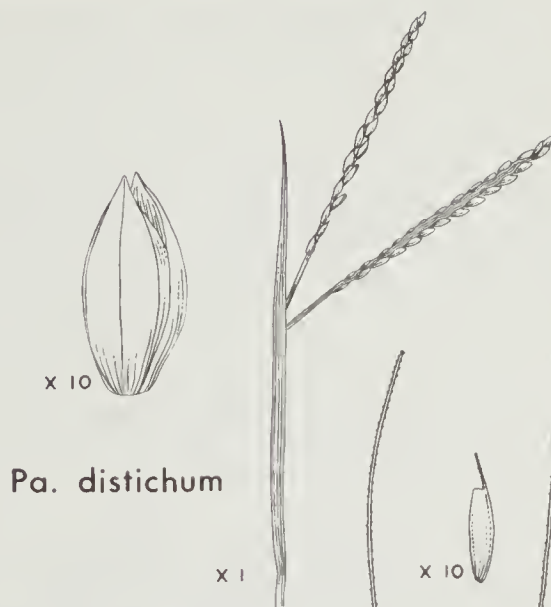
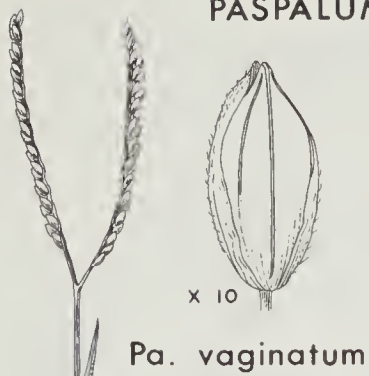
Spikelets 1-flowered. Glumes about equal. Callus with numerous silky hairs about as long as the lemma.

- a. Spikelets longer than 4.5 mm; awn attached about one-fourth of distance below lemma tip; callus hairs about two-thirds as long as the lemma, with an individual brush of longer hairs....1. *C. cinnoides*
- a. Spikelets shorter than 4.5 mm; awn attached near base of lemma; callus hairs about equaling lemma, with no individual brush of hairs.....2. *C. canadensis*

PASPALUM

ALOPECURUS

POLYPOGON



x 1/2

*A. carolinianus*

x 1/2

*Po. monspeliensis*

1. *Calamagrostis cinnoides* (Muhl.) Barton

Frequent in low ground, ditches, swamps, and bogs chiefly in the Blue Ridge and Coastal Plain provinces of North Carolina. Extending northward into Maine, southward into Georgia and westward into New York, West Virginia, Kentucky, Tennessee, Alabama, and Louisiana.

2. *Calamagrostis canadensis* (Michx.) Beauv.

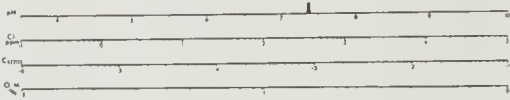
Rare in wet meadows, swamps, and bogs in the Blue Ridge Province of North Carolina. Extending northward into Maine and westward to the Pacific coastal states; Arizona, New Mexico, Kansas, Missouri, and Tennessee.

13. PHALARIS: *Canary Grass*

Spikelets laterally compressed, with two minute sterile lemmas below the fertile floret. Glumes usually 3-nerved, almost equal in length. Fertile lemmas 1-nerved.

1. *Phalaris arundinacea* L.

Frequent in low ground, stream margins, and marshes chiefly in the Blue Ridge Province of North Carolina. Extending throughout the United States except in the southeast.



14. SACCIOLEPIS

Spikelets asymmetrically ovoid. First glume 3-5-nerved, the second glume gibbous. Sterile lemma below the fertile floret, 2-keeled. Fertile lemma and palea faintly nerved.

1. *Sacciolepis striata* (L.) Nash

Frequent in low ground, ditches, swamps, marshes, and shallow water chiefly in the Coastal Plain of North Carolina. Extending northward into New Jersey, southward, along the Atlantic and Gulf coasts, into Florida and eastern Texas; Tennessee and Oklahoma.



15. PANICUM: *Panic-grass*

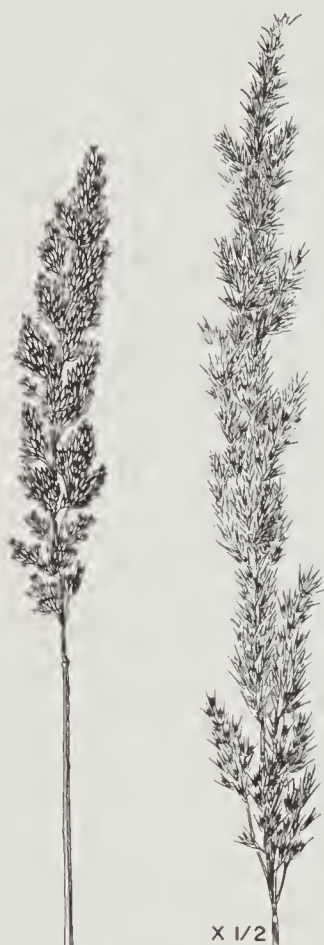
Spikelets with a sterile, neutral, or staminate floret below the terminal fertile floret. First glume usually present but smaller than the second glume. Sterile lemma similar to the second glume. Fertile floret with hard and enrolled lemma enclosing the hard palea.

- a. Spikelets sessile to short pedicellate, closely aggregated along one side of the rachis; strongly rhizomatous....1. *P. hemitomon*
- a. Spikelets pedicelled in an open or contracted panicle; either with rhizomes or hardened bases and persistent stubble of old growth.
- b. Palea of sterile floret exceeding its glume, thickened and hard, expanding the spikelet at maturity.....2. *P. hians*
- b. Palea of sterile floret shorter than its glume, not thickened.

CALAMAGROSTIS

PHALARIS

SACCIOLEPIS



*C. cinnoides*



*S. striata*



*C. canadensis*

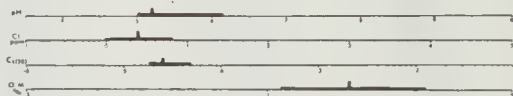
*P. arundinacea*



- c. Spikelets not more than 3 mm long; culms firm to soft.
  - d. Floret stipitate; spikelet 2.3 mm or more in length..
    - .....3. *P. stipitatum*
  - d. Floret sessile; spikelet 2.2 mm or less in length..
    - .....4. *P. agrostoides*
- c. Spikelets more than 3.5 mm long; culm hard and rigid.
  - e. Panicle elongate, strongly contracted; culms in dense tufts.....5. *P. amarum*
  - e. Panicle diffuse; culms arising from an elongate rhizome.....6. *P. virgatum*

1. *Panicum hemitomon* Schul., Maiden-cane

Infrequent in shallow water of ditches, ponds, marshes, and swamps in the southern half of the Coastal Plain of North Carolina. Extending into New Jersey and southward, along the Atlantic and Gulf coasts, into Florida and Texas.



2. *Panicum hians* Ell.

Frequent in low ground, seepage areas, ditches, marshes, and margins of streams and ponds in the outer Piedmont and Coastal Plain of North Carolina. Extending northward into Virginia and southward, along the Atlantic and Gulf coasts, into Florida and Texas, thence northward into Missouri and Oklahoma.



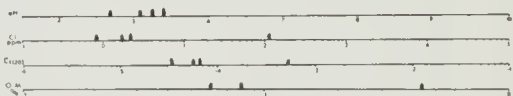
3. *Panicum stipitatum* Nash

Common in low ground, ditches, swamps, and marshes throughout North Carolina. Extending northward into southern New England, southward into Georgia and westward into New York, Ohio, Indiana, Missouri, Arkansas, and Texas.



4. *Panicum agrostoides* Spreng.

Frequent in low ground, ditches, marshes, and along shores of streams and ponds in the Piedmont and Coastal Plain provinces of North Carolina. Extending northward into Maine, southward into Florida and westward into Michigan, Illinois, Nebraska, Oklahoma, and Texas; California.

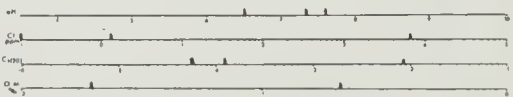


5. *Panicum amarum* var. *amarulum* (Hitch. & Chase) P. G. Palmer, Beachgrass

Infrequent in sandy swales and marshes in the Coastal Plain of North Carolina. Extending northward into New Jersey and southward, along the Atlantic and Gulf coasts, into Florida and Texas. [*Panicum amarulum* Hitch. & Chase]

6. *Panicum virgatum* L., Switchgrass

Common in low ground, margins of ponds and streams, and in brackish marshes chiefly in the outer Piedmont and Coastal Plain of North Carolina.





# PANICUM



*P. hemitomon*



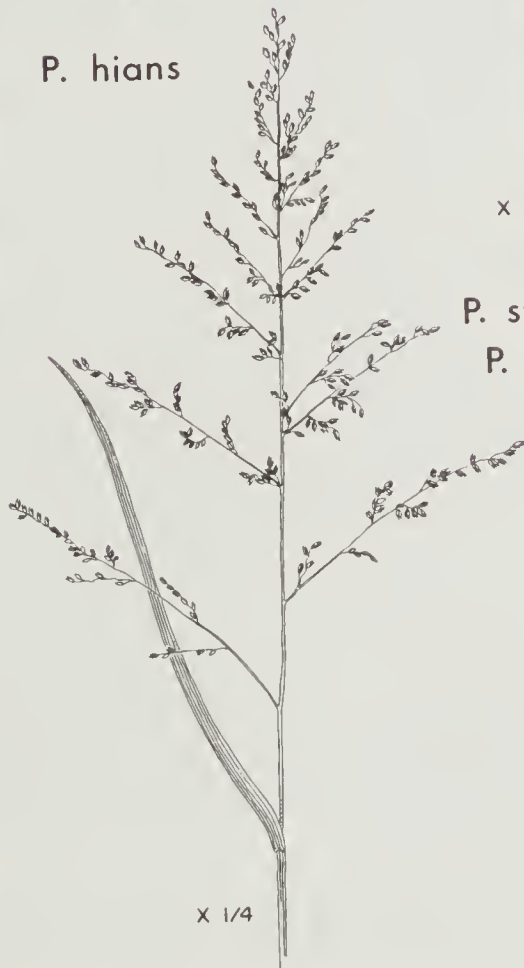
*P. hians*



*P. stipitatum* &  
*P. agrostoides*



*P. amarum*



*P. virgatum*

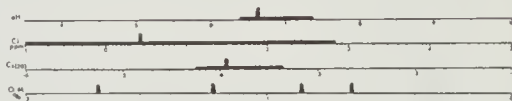
Extending throughout the United States except in the northwest and Pacific states. [Includes *Panicum virgatum* var. *cubense* Griseb.]

## 16. ZIZANIA: Wild-rice

Spikelets 1-flowered, the male pendulous on the lower spreading inflorescence branches, the female appressed to the upper, ascending branches. Glumes absent.

### 1. *Zizania aquatica* L.

Frequent in fresh to brackish marshes and streams in the outer Coastal Plain of North Carolina. Extending throughout the eastern half of the United States.

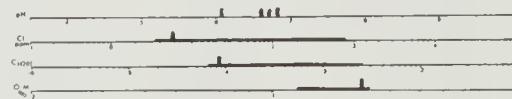


## 17. ZIZANIOPSIS: Southern Wild-rice, Water Millet

Spikelets 1-flowered, the male toward the base of the inflorescence branches, the female terminal on the same branches. Glumes absent.

### 1. *Zizaniopsis miliacea* (Michx.) Doell & Aschers.

Frequent in fresh to brackish marshes and streams chiefly in the Coastal Plain of North Carolina. Extending northward into Maryland, southward into Florida and westward into Kentucky, Missouri, Oklahoma, and Texas.



## --CYPERACEAE--

In contrast to the grasses, which the sedges superficially resemble, many of the sedge genera are well represented in marsh and aquatic habitats both fresh and brackish. Like the grasses, the sedges exhibit few morphological adaptations to the aquatic habitat.

The ultimate inflorescence in the sedges is a spikelet but, unlike the grasses, there are no glumes subtending florets and no lemmas and paleas. Rather, the basic sedge spikelet consists of a central axis upon which numerous sessile flowers are usually spirally arranged (2-ranked in *Dulichium*, *Cyperus* and some species of *Eleocharis*). Each flower is subtended by a single scale. In some genera (e.g., *Rhynchospora*) several of these scales are sterile. Flowers in the sedges are typically bisexual (unisexual in *Carex*) with perianth parts absent or represented by broadened scales (e.g., *Fuirena*) or bristles (e.g., *Scirpus*). For additional characteristics typical of sedges and grasses refer to the comparative list under Poaceae.

Many of the sedges are difficult, if not impossible, to identify without mature spikelets. Thus, care should be taken in collecting these plants to insure the availability of fruiting material for positive identification.

- a. Nutlet enclosed in a perigynium; flowers unisexual.....1. *Carex*
- a. Nutlet not enclosed in a perigynium; flowers bisexual.

ZIZANIA

ZIZANIOPSIS



*Zizania aquatica*



*Zizanio. milacea*

- b. Spikelet solitary, terminal, without involucre leaves;  
leaf reduced to a sheath, the blade, if present, minute  
and terete.....2. *Eleocharis*
- b. Spikelets few-to-many (rarely solitary); inflorescence  
subtended by 1-many leafy bracts or arising from the  
sheaths of a leafy culm.
- c. Scales of the spikelet distichous.
  - d. Inflorescences axillary.....3. *Dulichium*
  - d. Inflorescence terminal.....4. *Cyperus*
- c. Scales of the spikelet spirally imbricated.
  - e. Spikelets mostly 1-4-flowered, with 2-many empty  
basal scales.
    - f. Nutlet crowned with a tubercle; perianth bristles  
usually present.....5. *Rhynchospora*
    - f. Nutlet without a tubercle; perianth bristles  
usually absent.....6. *Cladium*
  - e. Spikelets mostly more than 4-flowered, with only  
one empty basal scale (except more in *Eriophorum*).
  - g. Flowers with one or more inner subtending scales  
or with dilated sepal-like bristles internal to  
the primary subtending bract.
    - h. Inner scales consisting of 3 bristles alternating  
with 3 broadly dilated sepal-like bristles.....7. *Fuirena*
    - h. Inner scales consisting of two small, blunt,  
basal bracts.....8. *Lipocarpus*
  - g. Flowers without inner subtending scales.
    - i. Style dilated at base.....9. *Fimbristylis*
    - i. Style base terete, slender.
      - j. Perianth of 0-8 bristles.....10. *Scirpus*
      - j. Perianth of very many long-silky bristles..11. *Eriophorum*

# 1. CAREX: Sedge

Flowers unisexual, in separate spikelets or in the same spikelet.  
Female flowers with the nutlet enclosed in a perigynium.

- a. Spikelet(s) uniform, bearing both male and female flowers  
in the same spikelet.
- b. Flowers toward the spikelet tip male.
  - c. Spikelet solitary.....1. *C. leptalea*
  - c. Spikelets two or more per culm.
    - d. Rhizomes long; culms arising individually along the  
rhizome; plant of brackish marshes.....2. *C. divisa*
    - d. Rhizomes short; culms arising in clumps; plant of  
freshwater areas.
    - e. Perigynia corky at base; leaf sheaths loose.
      - f. Base of perigynium disk-like; beak of  
perigynium 2-3-times as long as the body...3. *C. crus-corvi*
      - f. Base of perigynium not disk-like, continuous  
with the body; beak of perigynium 1-2-times as  
long as the body.
        - g. Leaf sheaths thin-margined at the mouth....4. *C. stipata*
        - g. Leaf sheaths firm-margined at the mouth....  
.....5. *C. laevivaginata*
    - e. Perigynia not corky at base; leaf sheaths tight.

- h. Pistillate scales not awned; perigynia blackish..  
.....6. *C. decomposita*
- h. Pistillate scales awned; perigynia yellow to green.
  - i. Beak of perigynium about as long as the body; shoulder of perigynium smooth.....7. *C. vulpinoidea*
  - i. Beak of perigynium much shorter than the body; shoulders of perigynium with several fine teeth.....8. *C. annectens*
- b. Flowers toward the spikelet tip female.
  - j. Body of perigynium widest above the middle.
    - k. Pistillate scales obtuse to acute.....9. *C. albolutescens*
    - k. Pistillate scales acuminate, often with awn-like tips..  
.....10. *C. alata*
  - j. Body of perigynium widest toward the base.
    - l. Perigynia about 3-4-times as long as broad, beak about as long as the body.....11. *C. scoparia*
    - l. Perigynia about 2-times as long as broad, beak much shorter than the body.....12. *C. reniformis*
- a. Spikelets not uniform, some bearing only male or female flowers (sometimes also some spikelets with female flowers below and male above).
  - m. Nutlets lenticular.
    - n. Beak of perigynium bent or twisted; lowest pistillate spikelet spreading or drooping.....13. *C. torta*
    - n. Beak of perigynium straight; lowest pistillate spikelet erect.....14. *C. stricta*
  - m. Nutlets triangular in cross-section.
    - o. Perigynium barely, if at all, forked at apex; style jointed at base, not persistent, soon withering.....15. *C. joorii*
    - o. Perigynium distinctly forked at apex; style base not jointed, persistent, firm.
    - p. Length of perigynium 13-20 mm.....16. *C. lupulina*
    - p. Length of perigynium 10 mm or less.
      - q. Teeth of perigynia short, less than 0.9 mm long.
        - r. Nerves of the perigynia fine, indistinct; scales about equalling the perigynia.....17. *C. hyalinolepis*
        - r. Nerves of the perigynia coarse, distinct; scales obviously shorter than the perigynia.....18. *C. lurida*
      - q. Teeth of perigynia 1-2 mm long.
        - s. Perigynia pubescent.....19. *C. trichocarpa*
        - s. Perigynia glabrous.....20. *C. comosa*

Numerous other species of *Carex* may be found in low ground, pond margins, bogs, and on tussocks in marshes. Thus, if one of the following species is not clearly indicated a more comprehensive manual should be consulted.

#### 1. *Carex leptalea* Wahl.

Frequent in low ground and bogs of scattered localities throughout North Carolina. Extending throughout the United States.

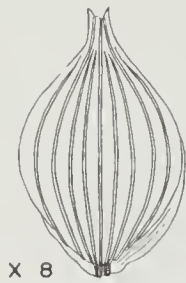




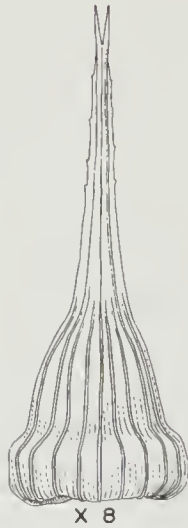
# CAREX



x 8



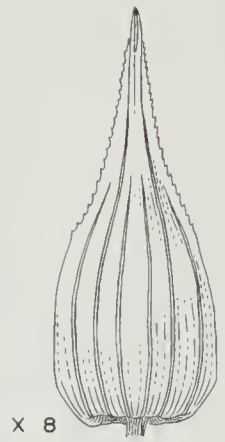
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x 8



x 1



x 8



x 1



x 1

*C. divisa*

*C. crus-corvi*

*C. leptalea*



x 8



x 8



x 1

*C. decomposita*



x 1

*C. laevivaginata*



x 1

*C. vulpinoidea*



x 1

*C. annectens*



x 1

*C. stipata*



x 8

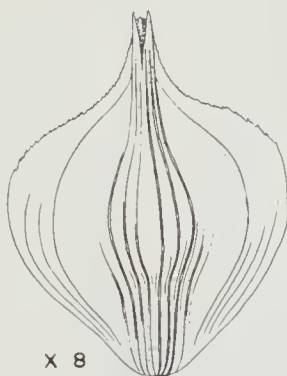


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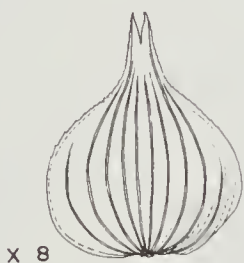
# CAREX



C. albolutescens



C. alata



C. reniformis



C. scoparia



C. torta



C. stricta

# CAREX



*C. jorii*



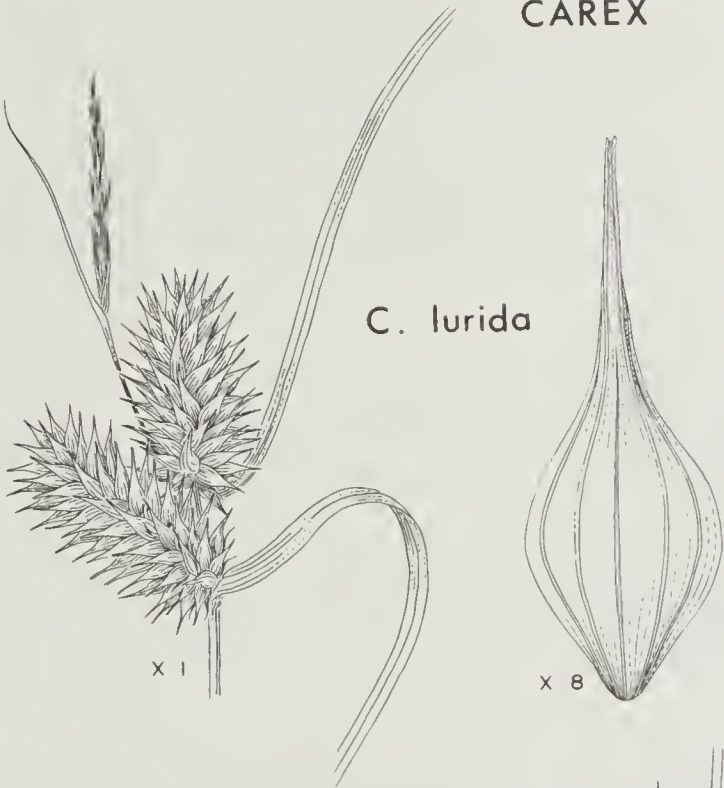
*C. lupulina*



*C. hyalinolepis*

CAREX

*C. lurida*



*C. comosa*



*C. trichocarpa*





2. *Carex divisa* Huds.

Very rare in brackish marshes in New Hanover County, North Carolina. An introduction from Europe; Maryland.

3. *Carex crus-corvi* Shutt. ex Kuntze

Rare in low ground, sloughs, and swamps in the Coastal Plain of North Carolina. Extending northward into Virginia, southward into Florida and westward into Ohio, Michigan, Wisconsin, southern Minnesota, eastern Nebraska, and Texas.

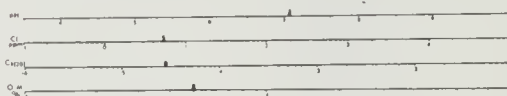
4. *Carex stipata* Muhl. ex Schkuhr

Common in low ground, ditches, and marshes throughout North Carolina. Extending throughout the United States.



5. *Carex laevivaginata* (Kuken.) Mack.

Common in low ground, swamps, and marshes throughout North Carolina. Extending northward into Maine, southward into Florida and westward into Minnesota, Missouri, and Texas.

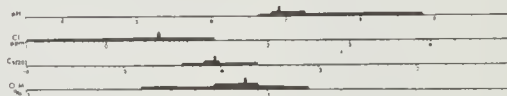


6. *Carex decomposita* Muhl.

Very rare in swamps in New Hanover and Warren counties of North Carolina. Extending northward into Virginia, southward into Florida and westward into New York, Ohio, Michigan, Missouri, Louisiana, and Texas.

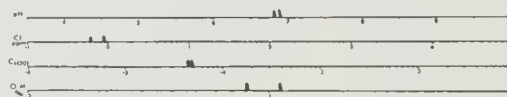
7. *Carex vulpinoidea* Michx.

Common in low ground and marshes throughout North Carolina. Extending throughout the United States.



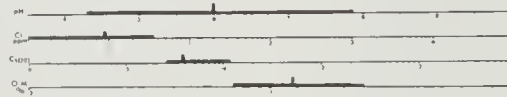
8. *Carex annectens* Bickn.

Frequent in low ground, ditches, and marshes chiefly in the Piedmont and Coastal Plain provinces of North Carolina. Extending northward into Maine, southward into Florida and westward into Wisconsin, Kansas, Missouri, and Texas.



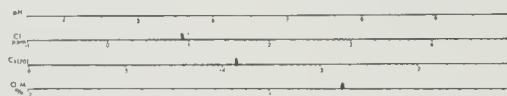
9. *Carex albolutescens* Schwein.

Common in low ground, swamps, and marshes chiefly in the outer Piedmont and Coastal Plain of North Carolina. Extending northward into New Hampshire, southward into Florida and westward into Pennsylvania, Michigan, Illinois, Missouri, and Texas. [*C. longii* Mack.]



10. *Carex alata* Torr.

Frequent in low ground and marshes in the outer Piedmont and Coastal Plain of North Carolina. Extending northward into Massachusetts, southward





into Florida and westward into Ohio, Michigan, Indiana, Missouri, and Texas.

11. *Carex scoparia* Schkuhr

Common in low ground, pond margins, and marshes, chiefly in the Blue Ridge and Piedmont provinces of North Carolina. Extending northward into New England, southward into South Carolina, and westward into Oregon and Arkansas; Arizona and New Mexico.



12. *Carex reniformis* (Bailey) Small

Rare in low ground, ditches, swamps, and marshes in Johnston and Wake counties of North Carolina. Extending northward into Virginia, southward into Florida and westward into Texas, thence northward into Oklahoma and Arkansas.

13. *Carex torta* Boott

Infrequent in streams in the Blue Ridge and outer Piedmont of North Carolina. Extending northward into New England, southward into Georgia and westward into Minnesota and Arkansas.

14. *Carex stricta* Lam.

Frequent in low ground, swamps, and marshes in the Blue Ridge and northern portions of the Piedmont and Coastal Plain provinces of North Carolina. Extending northward into New England and westward into Minnesota, Iowa, Illinois, Indiana, Ohio, and Tennessee; Texas. [Includes *C. strictior* Dewey]

15. *Carex joorii* Bailey

Frequent in low ground, swamps, pond margins, and marshes in the outer Piedmont and Coastal Plain provinces of North Carolina. Extending northward into Maryland and southward, along the Atlantic and Gulf coasts, into Florida and Texas, thence northward into Missouri and Tennessee.

16. *Carex lupulina* Muhl. ex Schkuhr

Common in low ground, swamps, and marshes throughout North Carolina. Extending throughout the eastern half of the United States.



17. *Carex hyalinolepis* Steud.

Infrequent in swamps and marshes in the Coastal Plain of North Carolina. Extending northward into New Jersey, southward into Florida and westward into Ohio, southern Wisconsin, Iowa, Nebraska, Kansas, and Texas. [*C. lacustris* var. *laxiflora* Dewey]

18. *Carex lurida* Wahl.

Common in low ground, ditches, and marshes throughout North Carolina. Extending throughout the eastern half of the United States.



19. *Carex trichocarpa* Muhl. ex Schkuhr

Rare in low ground and marshes in Ashe and Haywood counties of North Carolina. Extending northward into Vermont and westward into Minnesota, northern Iowa, Illinois, Indiana, and Ohio.

20. *Carex comosa* Boott

Frequent in low ground, marshes, and shallow water chiefly in the Coastal Plain of North Carolina. Extending northward into Maine, southward into Florida and westward into Michigan, Wisconsin, Nebraska, Kentucky, Tennessee, and Texas; California, Idaho and Washington.



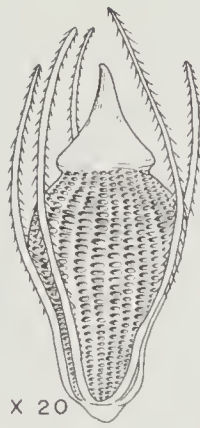
2. ELEOCHARIS: *Spike-rush*

Spikelets solitary and terminal on a leafless culm. Leaves reduced to bladeless sheaths. Style base persistent, forming a tubercle on the nutlet apex at maturity.

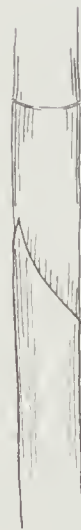
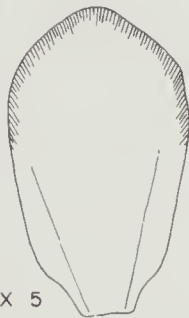
Variation within and among several species of *Eleocharis* is extensive. Experimental studies involving the *E. engelmannii/obtusata* complex as well as of the various forms of both *E. palustris* and *E. flavescens* should prove fruitful.

- a. Spikelet only slightly, if at all, thicker than the culm.
  - b. Scales of the spikelet herbaceous, keeled; spikelet few-flowered, culm 3-angled.....1. *E. robbinsii*
  - b. Scales of spikelet coriaceous, keelless; spikelet many-flowered; culm terete or quadrangular.
    - c. Culm terete, septate.....2. *E. equisetoides*
    - c. Culm quadrangular, nonseptate.....3. *E. quadrangulata*
- a. Spikelet conspicuously thicker than the culm.
  - d. Scales of the spikelet essentially 2-ranked; spikelets few-flowered.
    - e. Nutlet with prominent, straight, longitudinal ridges separated by numerous slender lines; plant never proliferating.....4. *E. acicularis*
    - e. Nutlet surface smooth, plant often proliferating...5. *E. baldwinii*
  - d. Scales of the spikelet spirally imbricated.
    - f. Culms conspicuously twisted and primarily 3-angled...
      - .....6. *E. tortilis*
    - f. Culms neither conspicuously twisted nor 3-angled.
      - g. Perianth bristles present, without barbs.....7. *E. cellulosa*
      - g. Perianth bristles barbed or absent.
        - h. Tubercle base approximately as wide as the nutlet.
          - i. Nutlet sharply constricted below a spongy tubercle.....8. *E. tuberculosa*
          - i. Nutlet not sharply constricted or not at all constricted below a firm tubercle.
            - j. Tubercle and nutlet trigonous; sheath truncate, strongly mucronate; often proliferating by rooting at the stem tip.....9. *E. melanocarpa*
            - j. Tubercle and nutlet bi-angular; sheath oblique, slightly mucronate; never proliferating by rooting at the stem tip.
              - k. Bristles, if present, equaling or shorter than the nutlet; tubercle not more than one-fourth as high as the body of the nutlet....10. *E. engelmannii*

# ELEOCHARIS



## *E. robbinsii*

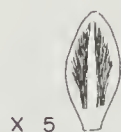


## *E. equisetoides*

# ELEOCHARIS



x 5



x 5



x 20



x 2



x 10



x 10

x 1

*E. acicularis*

*E. quadrangulata*



x 2



x 1/2

x 10



x 7



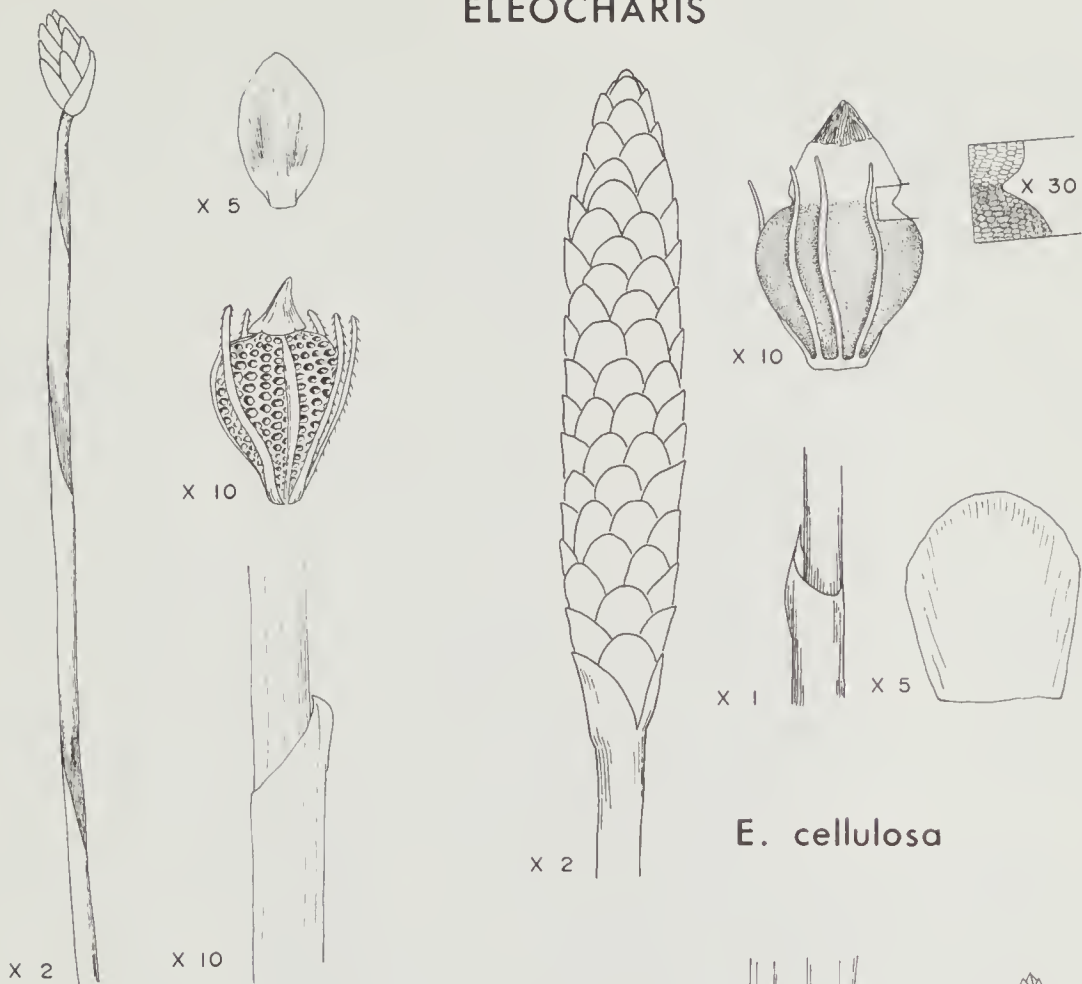
x 2



x 10

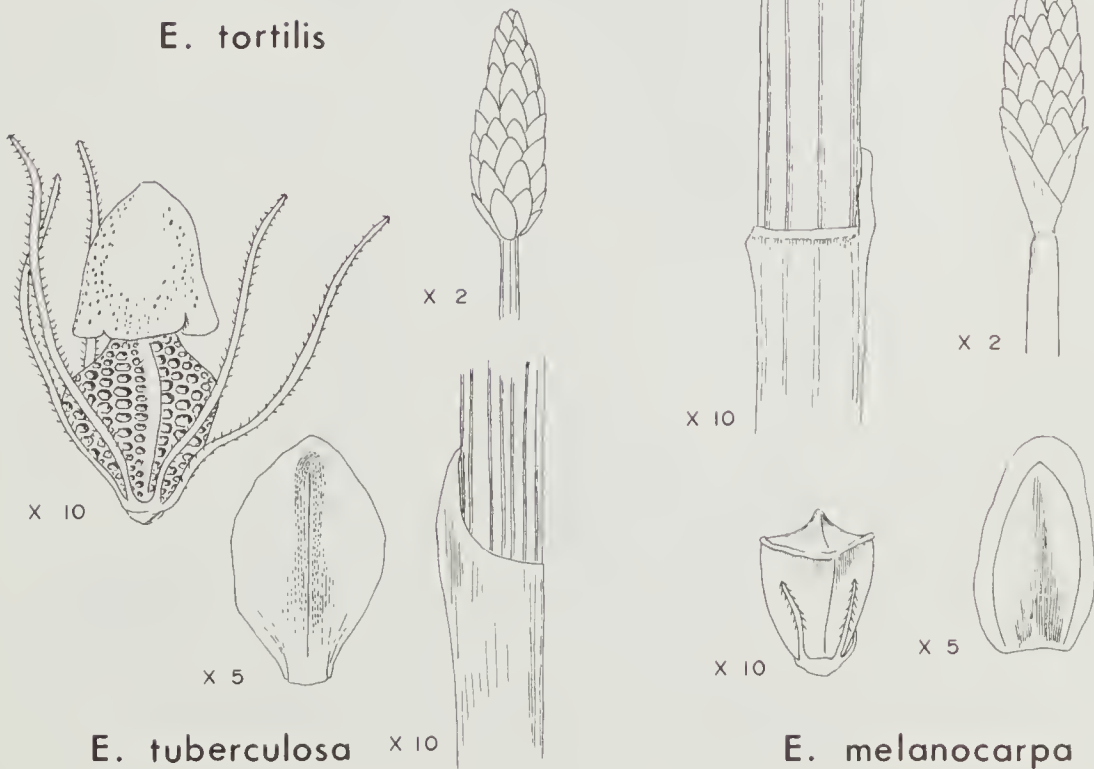
*E. baldwinii*

# ELEOCHARIS



*E. cellulosa*

*E. tortilis*



*E. tuberculosa*

*E. melanocarpa*

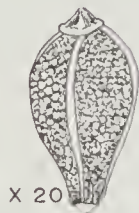


- k. Bristles, if present, exceeding the nutlet; tubercle usually at least one-third as high as the body of the nutlet.....11. *E. obtusa*
- h. Tubercle base less than two-thirds the width of the nutlet.
  - 1. Nutlet with 3 wing-like angles; surface of the nutlet roughened-reticulate; bristles absent.....12. *E. tricostrata*
  - 1. Nutlet either biconvex or trigonous, without wing-like angles; bristles usually present.
    - m. Surface of nutlet coarsely patterned, either reticulated or pitted.
      - n. Nutlet without bristles, surface coarsely pitted.....13. *E. tenuis*
      - n. Nutlet with bristles.
        - o. Bristles 2 or 3, less than one-half the length of the nutlet, deciduous; spikelets never proliferating; surface of nutlet coarsely pitted.....13. *E. tenuis*
        - o. Bristles more than 3, equaling the nutlet or longer, persistent.
          - p. Nutlet sharply constricted below the spongy tubercle; tubercle approximately the size of the nutlet body; spikelet never proliferating.....8. *E. tuberculosa*
          - p. Nutlet obscurely constricted below the tubercle; tubercle much smaller than the nutlet body; spikelet often proliferating.. .....14. *E. vivipara*
  - m. Surface of the nutlet smooth or finely reticulated.
    - q. Tubercle confluent with apex of the nutlet.
      - r. Sheath loose and membranous, strongly oblique; nutlet 1-1.3 mm long.....15. *E. parvula*
      - r. Sheath tight, firm, truncate to oblique; nutlet 2-3 mm long.....16. *E. rostellata*
- q. Tubercle distinctly differentiated from the apex of the nutlet.
  - s. Culm 4-angled; spikelets often proliferating.. .....17. *E. microcarpa*
  - s. Culm corrugated or terete; spikelets never proliferating.
    - t. Basal scale of spikelet completely encircling the base of the spikelet.
      - u. Sheath truncate and mucronate.....18. *E. montevidensis*
      - u. Sheath oblique, with or without a mucro.
        - v. Rhizome coarse, 1.5-2 mm thick.....19. *E. fallax*
        - v. Rhizome slender, less than 1.5 mm thick.
          - w. Spikelets 30-40-flowered; scales obtuse.....20. *E. erythropoda*
          - w. Spikelets 5-30-flowered; scales acute.....21. *E. halophila*
  - t. Basal scale not encircling the base of the spikelet.

ELEOCHARIS



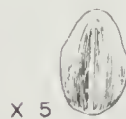
*E. engelmannii*



*E. tricostata*

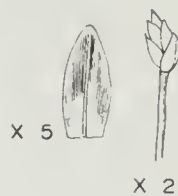
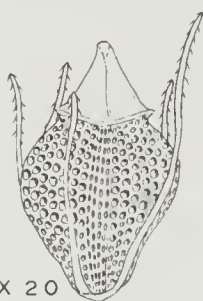
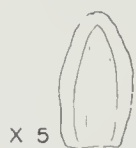


*E. obtusa*



*E. tenuis*

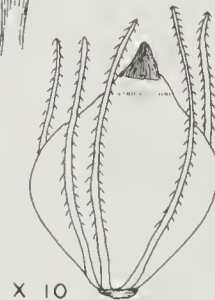
# ELEOCHARIS



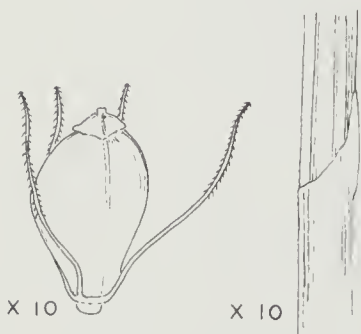
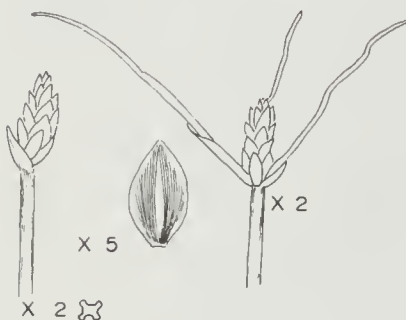
## *E. parvula*



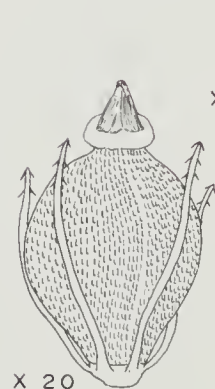
X 2



## *E. vivipara*



## *E. rostellata*



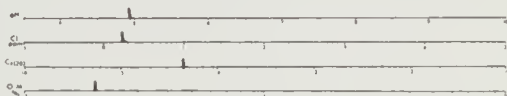
## *E. microcarpa*

## *E. montevidensis*

- x. Plants with firm, reddish, purple, or black strong rhizomes; sheath with a firm, tight, oblique margin.....22. *E. palustris*
- x. Plants tufted, with soft rhizomes; sheath with a scarious, loose, oblique margin.
- y. Sheath acute at the apex, concave along the sides of the orifice, often red-dotted just below the lowest portion of the orifice.....23. *E. albida*
- y. Sheath rounded at the apex, convex along the sides of the orifice, lacking red dots below the lowest portion of the orifice.....24. *E. flavescens*

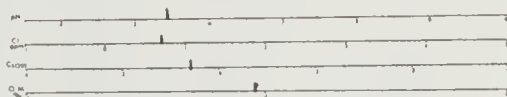
1. *Eleocharis robbinsii* Oakes

Rare but locally abundant in acidic pools in Bladen and Brunswick counties of North Carolina. Extending northward into Maine and New York and southward into Florida and Georgia; Great Lakes states of Minnesota, Wisconsin, Michigan, and Indiana.



2. *Eleocharis equisetoides* (Ell.) Torr.

Infrequent, but locally abundant, in ponds and lakes in the outer Piedmont and outer Coastal Plain of North Carolina. Extending northward into New York and Massachusetts and southward, along the Atlantic and Gulf states, into Texas; Wisconsin, Michigan, Illinois, Indiana, and Missouri.



3. *Eleocharis quadrangulata* (Michx.) R. & S.

Widely distributed in ponds and marshes throughout North Carolina. Extending northward into New England, southward into Florida and westward into Wisconsin, Illinois, Missouri, Oklahoma, and Texas.



4. *Eleocharis acicularis* (L.) R. & S.

Widely distributed in ditches and pond margins throughout North Carolina. Extending throughout the United States.

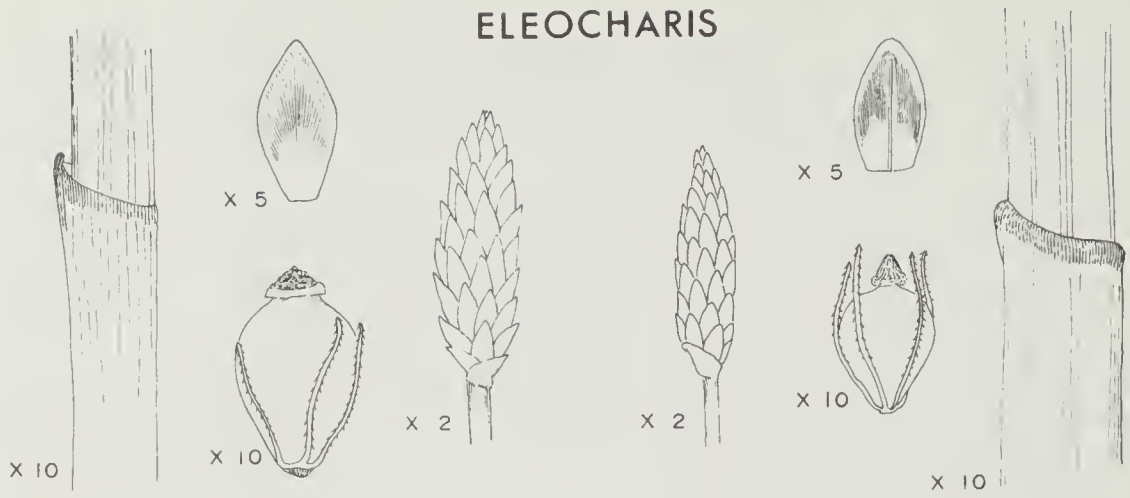


5. *Eleocharis baldwinii* (Torr.) Chap.

Locally abundant in acidic and organic water of ditches, ponds, and sluggish streams chiefly in the Coastal Plain of North Carolina. Extending northward into Virginia and southward into Georgia; also present in a lake in Louisiana that borders Texas. [*E. prolifera* Torr.]

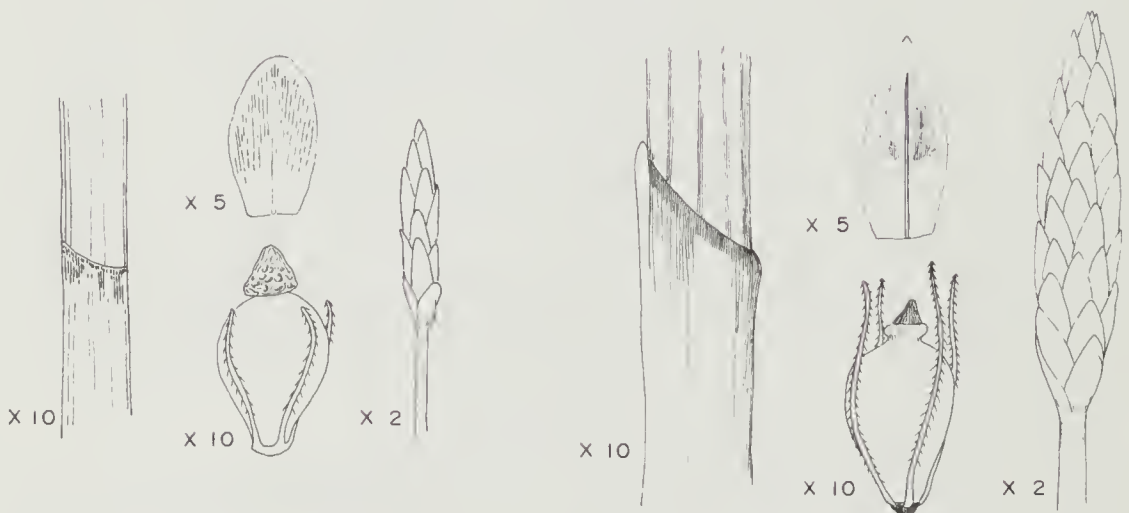


# ELEOCHARIS



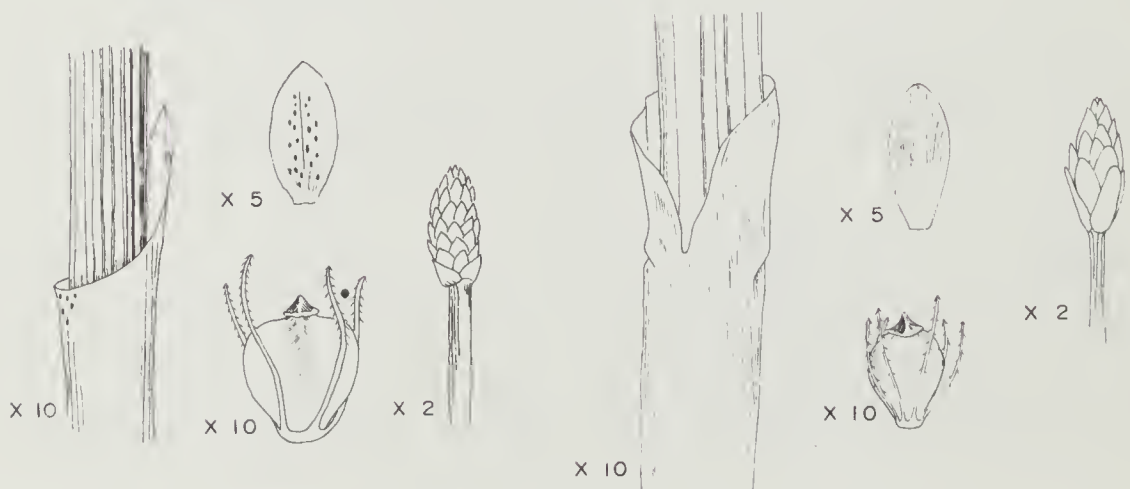
*E. fallax*

*E. erythropoda*



*E. halophila*

*E. palustris*



*E. albida*

*E. flavescens*



6. *Eleocharis tortilis* (Link) Schult.

Infrequent in wet woodlands, bogs, and savannahs chiefly in the Coastal Plain of North Carolina. Extending northward to Long Island and southward, along the Coastal Plain of the Atlantic and Gulf states, into Florida and Texas. [*E. simplex* (Ell.) A. Dietrich]

7. *Eleocharis cellulosa* Torr.

Rare in brackish marshes of Dare County, North Carolina. Extending southward, along the Atlantic and Gulf coasts, into Florida and Texas, thence inland into Oklahoma.

8. *Eleocharis tuberculosa* (Michx.) R. & S.

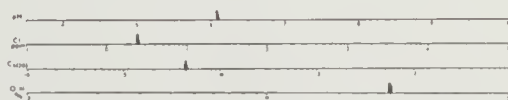
Abundant in acidic bogs, savannahs, and ditches in the Coastal Plain but infrequent in the Piedmont and Blue Ridge provinces of North Carolina. Ex-

Extending northward into New Hampshire, southward into Florida and westward into Tennessee, Arkansas, and Texas.



9. *Eleocharis melanocarpa* Torr.

Infrequent in moist, acidic pine lands and savannahs in the Coastal Plain of North Carolina. Extending northward into Massachusetts and southward into Florida; Michigan, Indiana, and Texas.



10. *Eleocharis engelmannii* Steud.

Infrequent along stream and pond margins in scattered locations throughout North Carolina. Extending throughout the United States except Florida, Montana, Wyoming, Colorado, Utah, Nevada, and Kansas. Probably not distinct from the following species.

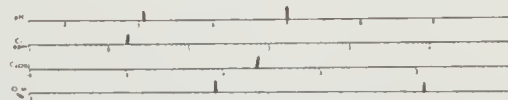
11. *Eleocharis obtusa* (Willd.) Schult.

Common in moist ground, margins of ponds and streams, and in ditches throughout North Carolina. Extending throughout the United States except for the Rocky Mountain states.



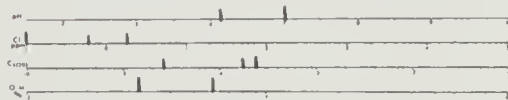
12. *Eleocharis tricostata* Torr.

Moist ground, bogs, and savannahs chiefly in the Coastal Plain of North Carolina. Extending northward, along the Coastal Plain, into Massachusetts and southward into Florida.



13. *Eleocharis tenuis* (Willd.) Schult.

Common in low woodlands, peaty soils, and meadows throughout North Carolina. Extending northward into New England, southward into Georgia and westward into Iowa, Kentucky, Tennessee, and Texas.



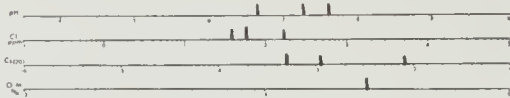
14. *Eleocharis vivipara* Link

Infrequent in acidic and organic water of bogs, pools, and sluggish streams in the Coastal Plain of North Carolina. Extending northward into Virginia and southward into Florida.



15. *Eleocharis parvula* (R. & S.) Link

Rare in brackish marshes in the outer Coastal Plain of North Carolina. Extending northward into Maine and southward, along the Atlantic and Gulf coasts, into Texas, thence westward into California; inland in western New York, Michigan, and Minnesota. [*Scirpus natans* Spreng.]



16. *Eleocharis rostellata* Torr.

Rare in brackish marshes of Beaufort, Dare, and Hyde counties of North Carolina. Extending northward into New England and southward into Florida; Texas, New Mexico, Arizona, and the Great Lakes states.

17. *Eleocharis microcarpa* Torr.

Frequent in acidic and organic wet sand, bogs, ditches, and shallow pond margins chiefly in the Coastal Plain of North Carolina. Extending northward, in the Coastal Plain, into Connecticut and southward, along the Atlantic and Gulf states, into Texas; inland in Tennessee and Indiana. [Includes *E. brittonii* Svenson, *E. carolina* Small, *E. torreyana* Boeck.]

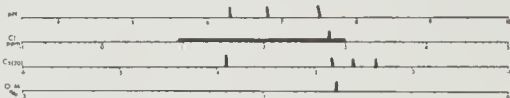


18. *Eleocharis montevidensis* Kunth

Very rare in wet sands of Currituck County of North Carolina. Extending southward, in the Coastal Plain, into Florida and Texas; Oklahoma, New Mexico, and Arizona. [*E. arenicola* Torr.]

19. *Eleocharis fallax* Weath.

Locally abundant in brackish marshes of the outer Coastal Plain of North Carolina. Extending northward into Massachusetts and southward, along the Atlantic and Gulf states, into Texas. [*E. ambigens* Fern.]



20. *Eleocharis erythropoda* Steud.

Rare in marshes, shallow ponds, and along streams in Ashe, Carteret, and Madison counties of North Carolina. Widely distributed throughout the United States except in the Deep South. [*E. calva* Torr.]

21. *Eleocharis halophila* Fern. & Brack.

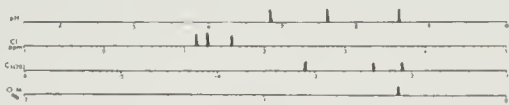
Very rare in brackish marshes of Dare County, North Carolina. Extending northward, along the Atlantic coastal states, into Maine.

22. *Eleocharis palustris* (L.) R. & S.

Very rare in marshes of Macon County, North Carolina. Widespread across the northern half of the United States and in Missouri, Kansas, Oklahoma, and Texas. [*E. smallii* Britt., *E. macrostachya* Britt.]

23. *Eleocharis albida* Torr.

Locally abundant in damp sand and shallow brackish water in the outer Coastal Plain of North Carolina. Extending northward into Maryland and southward, along the Atlantic and Gulf coasts, into Texas.



24. *Eleocharis flavescens* (Poir.) Urban

Locally abundant in sandy pond margins and marshes chiefly in the Coastal Plain of North Carolina. Extending northward into Maine, southward, along the Atlantic and Gulf states, into Texas, and westward into Minnesota, Wisconsin, Indiana, and Ohio; Arizona. Specimens from North Carolina exhibit a complete range of morphological features from those characteristic of *E. flavescens* to those characteristic of *E. olivacea*. Consequently, the latter taxon is included in the former. [*E. flaccida* (Reich.) Urban, *E. olivacea* Torr., *E. flavescens* var. *olivacea* (Torr.) Gleason]



3. DULICHIMUM: Three-way Sedge

Spikelets 2-ranked, flattened, borne on axillary inflorescences which arise from the 3-ranked leaf sheaths.

1. *Dulichium arundinaceum* (L.) Britt.

Abundant in acidic and organic waters of pond and stream margins throughout North Carolina except in the central Piedmont. Extending northward into Maine, southward into Florida and westward into Minnesota, Nebraska, and Texas; California and the northwestern states.



4. CYPERUS: Umbrella-sedge

Spikelets 2-ranked, usually flattened, borne in a terminal umbellate or capitate inflorescence subtended by few-to-several leafy involucre bracts.

- a. Spikelets tightly compacted into dense capitate heads, individual spikelets barely distinguishable without magnification.
- b. Flowers several per spikelet; at least some capitate heads borne on elongate rays.....1. *C. pseudovegetus*
- b. Flower solitary per spikelet; capitate heads not borne on long rays.
- c. Spikelet length 2.5 mm or less; leaf blades 1-3 mm wide; plants 0.5-2.5 dm tall.....2. *C. tenuifolius*
- c. Spikelet length more than 2.5 mm; leaf blades 3-4 mm wide; plants 1.3-5 dm tall.....3. *C. sesquiflorus*
- a. Spikelets more-or-less loosely arranged and individually distinguishable without magnification, many flowered.
- d. Inflorescence an irregular panicle of loosely ascending spikelets.....4. *C. iria*
- d. Inflorescence an umbellate or pinnate arrangement of spikelets.

## DULICHIMUM



*D. arundinaceum*

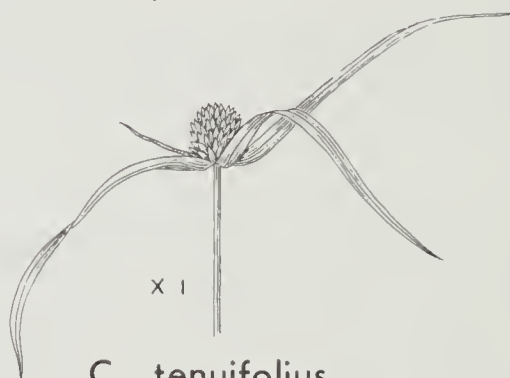


*C. iria*

## CYPERUS



*C. pseudovegetus*



*C. tenuifolius*



*C. sesquiflorus*



- e. Spikelets in a compound umbel.....5. *C. virens*
- e. Spikelets pinnately arranged or in simple umbellate clusters, never compound umbellate.
- f. Nutlet lenticular to plano-convex; stigmas usually 2; spikelet distinctly flattened.
- g. Scales reddish-purple.....6. *C. rivularis*
- g. Scales yellowish to brown.
- h. Nutlet irregularly and coarsely reticulate, about as broad as long.....7. *C. flavescens*
- h. Nutlet regularly and finely honeycomb-reticulate, longer than broad.
- i. Scales 1.5-2.2 mm long.....8. *C. polystachyos*
- i. Scales 2.5-3 mm long.....9. *C. filicinus*
- f. Nutlet triangular; stigmas usually 3; spikelet subterete to cylindric.
- j. Scales 1.3-1.5 mm long; nutlet less than 1 mm long, ivory colored, lustrous; roots and basal portion of stem reddish.....10. *C. erythrorhizos*
- j. Scales 1.8-5 mm long; nutlet more than 1 mm long, brown to reddish.
- k. Rachilla disarticulating between flowers; scales coriaceous or firm; nutlet silvery brown; plant an annual.....11. *C. odoratus*
- k. Rachilla not disarticulating between flowers; scales not coriaceous; plant a perennial.
- 1. Scales 3 mm or more long, yellowish, with a green midrib (at least when young); nutlet reddish; rachilla deciduous.....12. *C. strigosus*
- 1. Scales about 2 mm long, brownish, with a conspicuous non-green midrib; nutlet dark brown, rachilla not deciduous.....13. *C. distans*

#### 1. *Cyperus pseudovegetus* Steud.

Common in low ground, swamps, and marshes in the Piedmont and Coastal Plain provinces of North Carolina.

Extending northward into New Jersey, southward into Florida and westward into Indiana, Illinois, Kansas, Missouri, and Texas. [*C. virens* of some Am. authors, not Michx.]



#### 2. *Cyperus tenuifolius* (Steud.) Dandy

Common in low ground, ditches, and marshes throughout North Carolina. Extending northward into Long Island, southward into Florida and westward into Pennsylvania, Ohio, Indiana, Illinois, Missouri, Kansas, Oklahoma, and Texas. [*Kyllinga pumila* Michx., *C. densicaespitosus* Mattf. & Kuken.]

#### 3. *Cyperus sesquiflorus* (Torr.) Mattf. & Kuken.

Infrequent in low ground, ditches, and marshes chiefly in the Coastal Plain of North Carolina. Extending southward, along the Atlantic and Gulf coasts, into Florida and Texas. [*Kyllinga odorata* Vahl]



# CYPERUS



x 1



x 4

*C. virens*



x 4



x 1



x 1

*C. rivularis*



x 4

*C. flavescens*



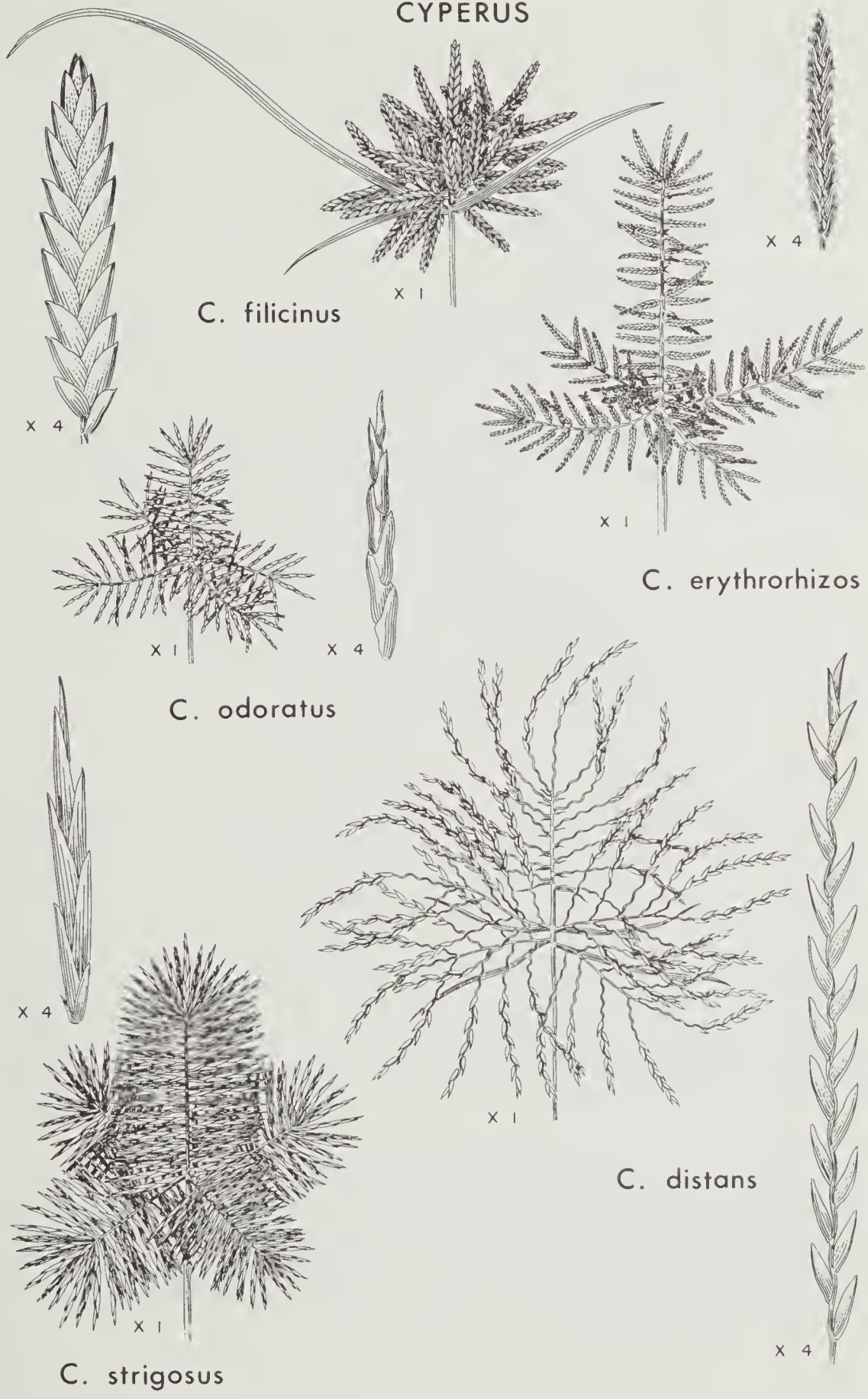
x 1



x 4

*C. polystachyos*

CYPERUS



4. *Cyperus iria* L.

Frequent in low ground, ditches, and marshes in the outer Piedmont and Coastal Plain of North Carolina. Extending northward into Virginia and southward, along the Atlantic and Gulf coasts, into Florida and Texas. An introduction from Eurasia.

5. *Cyperus virens* Michx.

Very rare in low ground, ditches, and marshes in Carteret County of North Carolina. Extending, along the Atlantic and Gulf coasts, into Florida and Texas; California.

6. *Cyperus rivularis* Kunth

Infrequent in low ground, ditches, and marshes in scattered localities throughout North Carolina. Extending throughout the eastern half of the United States except in Florida; California.

7. *Cyperus flavescens* L.

Frequent in low ground, ditches, and marshes throughout North Carolina. Extending northward into New York, southward into Florida and westward into Michigan, Illinois, Missouri, Kansas, Oklahoma and Texas.

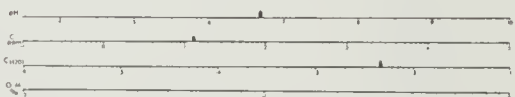
8. *Cyperus polystachyos* var. *texensis* (Torr.) Fern.

Common in low ground, ditches, and marshes in the Piedmont and Coastal Plain provinces of North Carolina. Extending northward into Massachusetts and southward, along the Atlantic and Gulf coasts, into Florida and Texas; in the interior to Missouri. [Includes *C. microdontus* Torr., *C. paniculatus* Rottb.]



9. *Cyperus filicinus* Vahl

Infrequent in moist sand and brackish marshes in the outer Coastal Plain of North Carolina. Extending northward into Maine and southward, along the Atlantic and Gulf coasts, into Florida and Louisiana.



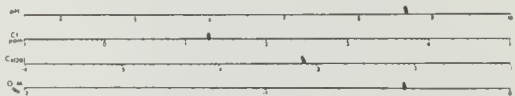
10. *Cyperus erythrorhizos* Muhl.

Infrequent in low ground, ditches, marshes, and swamps in scattered localities throughout the Piedmont and Coastal Plain provinces of North Carolina. Extending throughout most of the United States except in the extreme Northeast.



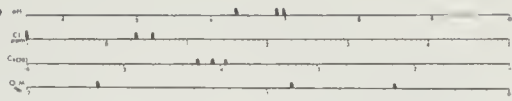
11. *Cyperus odoratus* L.

Infrequent in fresh or brackish low ground, ditches, and marshes chiefly in the Coastal Plain of North Carolina. Extending northward into Massachusetts, southward into Florida and westward into Minnesota, Missouri, and Texas; California. [Includes *C. ferax* Rich, *C. speciosus* Vahl, *C. longispicatus* Norton]



12. *Cyperus strigosus* L.

Common in low ground, ditches, swamps, and marshes throughout North Carolina. Extending northward into Maine, southward into Florida and westward into Minnesota, South Dakota, Nebraska, and Texas; Pacific coastal states. [Includes *C. praelongatus* Steud., *C. stenolepis* Torr.]



13. *Cyperus distans* L.f.

Very rare in low ground, swamps, and marshes in New Hanover County of North Carolina. Extending southward into Georgia.

5. RHYNCHOSPORA: *Beak-rush*

Spikelets with 1 or 2 fertile flowers and with 2 or more of the lower scales empty. Style base persistent as a tubercle.

- a. Tubercle more than 1 cm long.
  - b. Nutlet bristles shorter than the nutlet body, usually 5 in number.....1. *R. corniculata*
  - b. Nutlet bristles longer than the nutlet body.
    - c. Spikelets in clusters of 10 or more.....2. *R. macrostachya*
    - c. Spikelets solitary or in clusters of 2-6.....3. *R. inundata*
- a. Tubercle less than 1 cm long.
  - d. Spikelets in 1-6 dense capitate heads; tubercle about twice as long as the nutlet body.....4. *R. traceyi*
  - d. Spikelets not in dense capitate heads; tubercle much shorter than the nutlet body.
    - e. Tubercle deltoid, approximately 0.5 mm tall, at least as tall as wide.....5. *R. mixta*
    - e. Tubercle depressed-deltoid, approximately 4 mm or less tall, shorter than wide.....6. *R. miliacea*

Numerous other species of *Rhynchospora* may be found in low ground, ditches, and around ponds. Thus, if one of the following species is not clearly indicated a more comprehensive manual should be consulted.

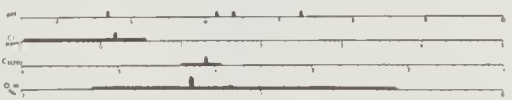
1. *Rhynchospora corniculata* (Lam.) Gray, *Horned-rush*

Common in low ground, ditches, and marshes in the Piedmont and Coastal Plain provinces of North Carolina. Extending northward into Delaware and southward, along the Atlantic and Gulf coasts, into Florida and Texas; interior in the Mississippi Valley into Indiana, Kentucky, Missouri, and Oklahoma.



2. *Rhynchospora macrostachya* Torr., *Horned-rush*

Frequent in ditches and marshes chiefly in the Coastal Plain of North Carolina. Extending northward into Maine, southward into Florida and westward into Michigan, Kansas, Missouri, and Texas.





# RHYNCHOSPORA



R. mixta



R. milacea



R. inundata



R. traceyi



R. macrostachya



R. corniculata

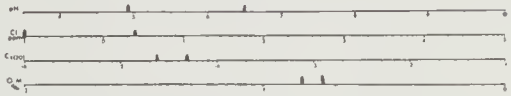


3. *Rhynchospora inundata* (Oakes) Fern., *Horned-rush*

Rare in ditches and marshes in Brunswick, Forsyth, and Moore counties of North Carolina. Extending northward into Massachusetts and southward into Florida.

4. *Rhynchospora traceyi* Britt.

Rare in ponds and marshes in Brunswick and New Hanover counties of North Carolina. Extending southward, along the Atlantic and Gulf coasts, into Florida and Mississippi.



5. *Rhynchospora mixta* Britt. ex Small

Frequent in low ground, swamps, and marshes in the outer Coastal Plain of North Carolina. Extending southward, along the Atlantic and Gulf coasts, into Florida and Texas. [*R. prolifera* Small]

6. *Rhynchospora miliacea* (Lam.) Gray

Infrequent in low ground, ditches, and marshes and around ponds in the outer Coastal Plain of North Carolina. Extending northward into Virginia and southward, along the Atlantic and Gulf coasts, into Florida and Louisiana.

6. CLADIUM

Spikelets 1-4-flowered with several empty basal scales. Nutlet without a tubercule.

- a. Leaf blades 1-3 mm wide, smooth or nearly so, becoming terete toward to apex.....1. *C. mariscoides*
- a. Leaf blades 5-10 mm wide, very rough on the margin and lower side of the midrib, becoming triangular toward the apex.....2. *C. jamaicense*

1. *Cladium mariscoides* (Muhl.) Torr.

Rare in bogs and marshes in the Blue Ridge and Coastal Plain provinces of North Carolina. Extending northward into Maine, southward into Florida and westward into Minnesota, Illinois, Kentucky, and Alabama.

2. *Cladium jamaicense* Crantz, *Saw-grass*

Common in brackish marshes in the outer Coastal Plain of North Carolina. Extending northward into southeastern Virginia and southward, along the Atlantic and Gulf coasts, into Florida and Texas.



7. FUIRENA: *Umbrella-grass*

Spikelets many-flowered, in terminal and occasionally axillary clusters. Perianth represented by 3 broadened scales.

It is the author's opinion that the following species are doubtfully distinct. They should make excellent subjects for experimental studies.

CLADIUM



C. mariscoides

C. jamaicense

- a. Plant perennial; perianth scales deltoid, short awned...  
.....1. *F. squarrosa*
- a. Plant annual; perianth scales ovate, with an awn  
as long as the body.....2. *F. pumila*

1. *Fuirena squarrosa* Michx.

Common in low ground, ditches, and marshes chiefly in the Piedmont and Coastal Plain provinces of North Carolina. Extending northward into New Jersey, southward into Florida and westward into Kentucky, Oklahoma, and Texas. [Includes *F. hispida* Ell., *F. breviseta* Cov.]



2. *Fuirena pumila* Torr.

Frequent in low ground and ditches in the Coastal Plain of North Carolina. Extending northward into Massachusetts and southward into Florida; Michigan, Illinois, and Indiana.



8. LIPOCARPHA

Spikelets terminal and sessile, subtended by leafy bracts. Nutlet with a basal callus.

1. *Lipocarpus maculatus* (Michx.) Torr.

Frequent in ditches and marshes in the Coastal Plain of North Carolina. Extending northward into Virginia and southward into Florida and Alabama; Pennsylvania.

9. FIMBRISTYLIS

Spikelets many-flowered, sessile and pedicellate in a terminal inflorescence. Style fringed, the base dilated.

1. *Fimbristylis spadicea* (L.) Vahl

Common in low swales, ditches, and brackish marshes in the Piedmont and Coastal Plain provinces of North Carolina. Extending northward into Long Island and southward, along the Atlantic and Gulf coasts, into Florida and Texas. [*F. anomala* Boech., *F. harperi* Britt., *F. puberula* (Michx.) Vahl, *F. castanea* (Michx.) Vahl, *F. drummondii* Boeck., *F. caroliniana* (Lam.) Fern.]

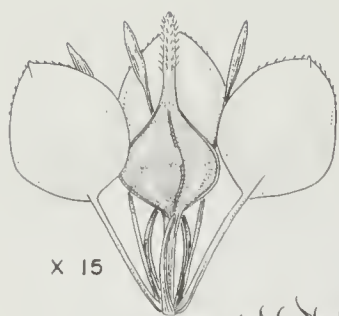


10. SCIRPUS: *Bulrush*

Spikelets many-flowered, in a terminal inflorescence subtended by one or more bracts (in some species the one involucral bract is erect and appears to continue the culm). Style base persistent but not dilated.

Several of the taxa included below are greatly in need of experimental analyses. For example 1) *S. olneyi* and *S. americanus* are, in the author's opinion, doubtfully distinct, 2) *S. validus* and *S. acutus* are also doubtfully dictinct, 3) the varieties of *S. cyperinus* exhibit characteristic distribution patterns but, perhaps, should not

FUIRENA LIPOCARPHA



X 15



X 2



X 15

*F. pumila*



X 1/4

*F. squarrosa*



X 1/2

*L. maculata*



be formally recognized as varieties and 4) the taxa *S. georgianus*, *S. flaccidifolius*, *S. atrovirens*, and *S. hattorianus*, although apparently exhibiting characteristic chromosomal uniqueness, do intergrade considerably (Schuyler, 1967). In the last mentioned case, the taxa are treated below as separate species but, are usually included in *S. atrovirens*.

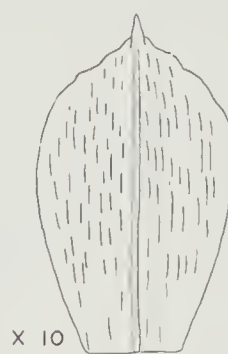
- a. Plants with inflorescence not subtended by foliaceous bracts but by a single bract (which appears as an extension of the culm) or by the lowest scale of the spikelet. Culm naked or leafy only toward the base.
- b. Plant an annual and without rhizomes; culms commonly cespitose.
  - c. Scales orbicular and rounded at apex, with tawny margins.....1. *S. purshianus*
  - c. Scales sharply keeled (deeply boat shaped), ovate, and acuminate at apex.....2. *S. koilolepis*
- b. Plant a perennial with elongate rhizomes; culms commonly scattered, not cespitose.
  - d. Spikelet(s) sessile, closely adhering to the culm, either solitary or in a tight glomerule.
    - e. Culm terete; leaves equalling the culm; nutlet sharply triangular.....3. *S. subterminalis*
    - e. Culm triangular; leaves not equalling the culm; nutlet planoconvex.
      - f. Upper leaf sheath with a V-shaped notch at the orifice; involucre bract 1-5 cm long, blunt; culm stout, 4-10 mm thick at the upper sheath; plant of saline and brackish marshes.....4. *S. olneyi*
      - f. Upper leaf sheath concave at the orifice; involucre bract 2-15 cm long, sharp pointed; culm more slender, 1-6 mm thick at the upper sheath; plant of various habitats.....5. *S. americanus*
  - d. Spikelets not all sessile; solitary or in glomerules at the ends of elongate rays.
    - g. Culm terete; involucre bract terete.....6. *S. validus*
    - g. Culm below the inflorescence sharply triangular, more obtusely so farther down; involucre bract triangular.....7. *S. etuberculatus*
- a. Plant with inflorescence subtended by a series of foliaceous involucre bracts; culm leafy.
  - h. Culm sharply triangular.
    - i. Spikelet ovoid; nutlet bristles deciduous.....8. *S. robustus*
    - i. Spikelet narrowly ovoid to cylindric; nutlet bristles persistent.....9. *S. cylindricus*
  - h. Culm obtusely triangular.
    - j. Bristles conspicuously exceeding the scales at maturity, often giving the inflorescence a wooly appearance.
      - k. Spikelets all solitary with distinct pedicels; involucre bracts with glutinous, black bases.....10. *S. longii*
      - k. Spikelets, at least some, clustered in glomerules.
        - 1. Spikelets mostly pedicellate, or at least the lateral ones of each group pedicellate.....
        - .....11b. *S. cyperinus* var. *eriphorum*



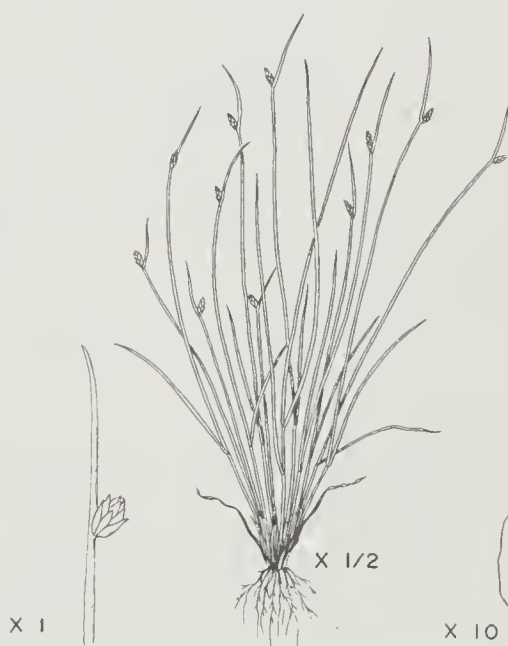
FIMBRISTYLIS SCIRPUS



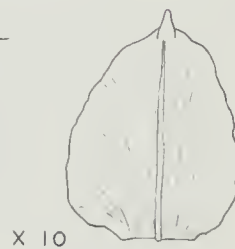
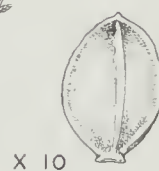
*F. spadicea*



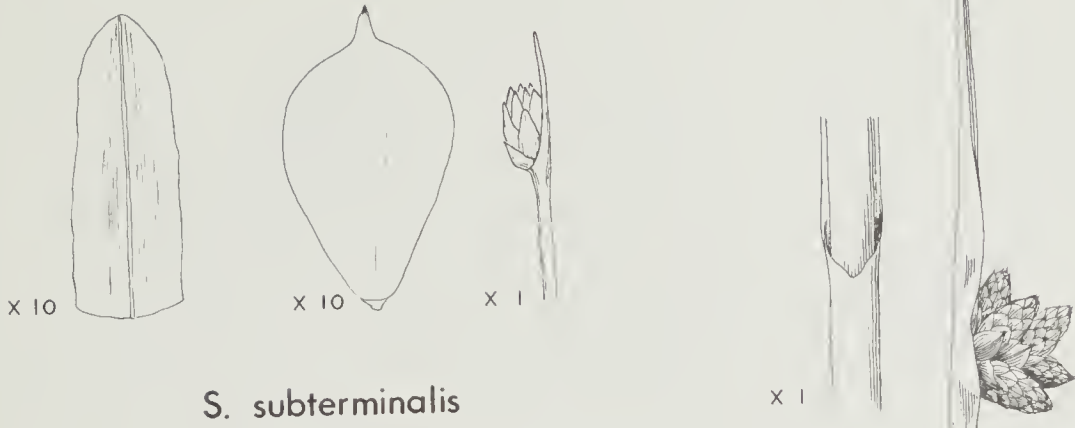
*S. purshianus*



*S. koilolepis*



# SCIRPUS

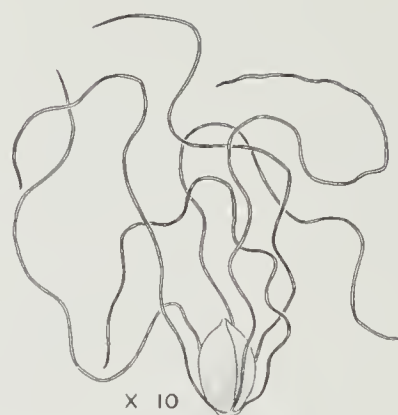


*S. validus*

# SCIRPUS



*S. etuberculatus*

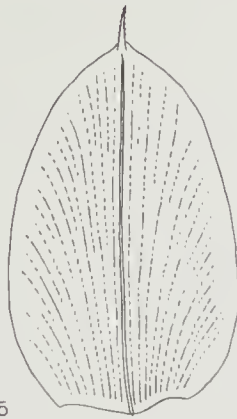


*S. longii*

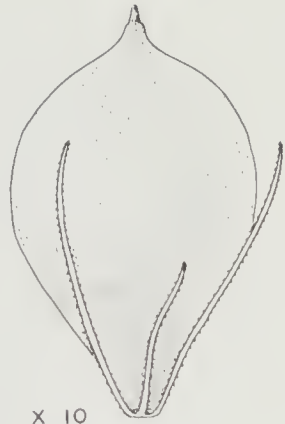
# SCIRPUS



x 1/2



x 5



x 10

## *S. cylindricus*



x 1/2



x 5



x 10



x 1.5

## *S. robustus*

1. Spikelets mostly in tight glomerules at the end of rays.
- m. Involucrals reddish-brown, the bristles reddish-brown at maturity.....11a. *S. cyperinus* var. *cyperinus*
- m. Involucrals blackish, bristles whitish to brownish at maturity.....11c. *S. cyperinus* var. *pelius*
- j. Bristles barely or not at all exceeding the scales, or absent. (Bristles may be actually much longer than the scale but in their contorted condition not exerted beyond the scale.)
- n. Bristles either not contorted or absent.
- o. Sheaths, at least the lower ones, red-tinged; bristles firm and sharply barbed to base but easily detached; scales broadly oval, median portion green.....12. *S. expansus*
- o. Sheaths green, not red-tinged; bristles, if present, with delicate barbs mostly restricted to the upper two-thirds of the bristle. (The following species are included within *S. atrovirens* by most authors.)
- p. Bristles 0-3, shorter than the nutlet; barbs, if present, concentrated near the tips of the bristles.....13. *S. georgianus*
- p. Bristles 5 to 6, shorter than to slightly longer than the nutlet; barbs extending downward from the tips of all, or at least some, of the bristles.
- q. Mature culms lax and reclining with inflorescences lapping over to (or nearly to) the ground; glomerules usually with less than 15 spikelets; lower scales of spikelet slightly mucronate, blackish.....14. *S. flaccidifolius*
- q. Mature culms upright or nearly so; glomerules frequently with more than 15 spikelets; lower scales of spikelets mucronate, blackish or brownish.
- r. Lower leaf blades and sheaths usually nodulose-septate; spikelets ovate or narrowly ovate; scales mostly brownish; longer bristles frequently exceeding the nutlet; nutlets about 1.1 mm long.....15. *S. atrovirens*
- r. Lower leaf blades and sheaths nearly smooth; spikelets broadly oval or ovate; scales mostly blackish; longer bristles usually shorter than or about equalling the nutlet; nutlets about 1 mm long.....16. *S. hattorianus*
- n. Bristles contorted, at least distally.
- s. Spikelets clustered in glomerules; bristles retrorsely barbed.....17. *S. polyphyllus*
- s. Spikelets all solitary, with distinct pedicles; bristles smooth or with few scattered hairs, not regularly retrorsely barbed.
- t. Cauline leaves 10 or more; internodes short; scale broadly ovate with wide, green, median portion and cucullate, with broad hyaline margin; nutlet pale to nearly white, regularly trigonous and scarcely beaked.....18. *S. divaricatus*
- t. Cauline leaves 10 or fewer, internodes prolonged; scale flattish, slender median portion excurrent as a subulate tip.



SCIRPUS



X 10



X 10



X 10



X 1



X 1



X 10



X 1

*S. cyperinus*

*S. expansus*



X 10



X 10



X 10



X 10

*S. flaccidifolius*



X 1

*S. atrovirens*



X 10

*S. georgianus*

*S. hattorianus*



X 1



X 10



X 10

*S. polyphyllus*

- u. Mature culm lax and reclining, with 2 or 3 lateral inflorescences in addition to the terminal inflorescence; rays with axillary bublets; bristles 6, mostly 2-4 mm long when extended.....19. *S. lineatus*
- u. Mature culm rigid and upright, usually with only a terminal inflorescence; rays without bublets; bristles variable but mostly more than 5 mm long when extended.....20. *S. pendulus*

1. *Scirpus purshianus* Fern.

Common in ditches, marshes, and shallow ponds chiefly in the Blue Ridge and less frequently in the Piedmont of North Carolina. Extending northward into Maine, southward into Georgia and westward into Minnesota, Wisconsin, Michigan, Indiana, Kentucky, Tennessee, and Alabama. [*S. debilis* Pursh, *S. smithii* var. *williamsii* (Fern.) Beetle]

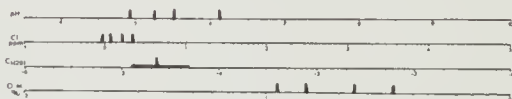


2. *Scirpus koilolepis* (Steud.) Gleason

Rare in low ground in the outer Piedmont of North Carolina. Extending southward into Georgia and westward into Tennessee, Missouri, Montana, and Texas; California.

3. *Scirpus subterminalis* Torr.

Rare in lakes, ponds, and streams in Cumberland, Moore, Richmond, and Scotland counties of North Carolina. Extending northward into Maine, southward into Georgia and westward into Minnesota, Wisconsin, Illinois, Indiana, and Pennsylvania; Missouri and the northwestern states.



4. *Scirpus olneyi* Gray

Rare in brackish marshes and ditches in Brunswick, Dare, and Hyde counties of North Carolina. Extending, along the Atlantic and Gulf coasts, northward into New Hampshire and southward into Florida and Texas; New York, Ohio, Michigan, Missouri, and the Rocky Mountain and Pacific coastal states.

5. *Scirpus americanus* Pers. Chair-maker's Rush

Frequent in fresh or brackish marshes, ditches, and shores of ponds or streams in the outer Piedmont and outer Coastal Plain of North Carolina. Extending throughout the United States.



6. *Scirpus validus* Vahl

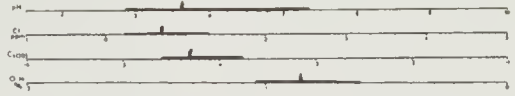
Frequent in fresh or brackish water of marshes and streams throughout North Carolina except for the inner Coastal Plain and adjacent Piedmont. Extending throughout the United States. [Includes *S. acutus* Muhl.]



The lack of distinctness between *S. validus* and *S. acutus* was noted in Iowa by Beal and Monson (1954) and documented in Minnesota by Miller & Beal (1972).

7. *Scirpus etuberculatus* (Steud.) Kuntze

Infrequent in swift flowing streams in the southern half of the Coastal Plain of North Carolina. Extending northward into Delaware and southward, along the Atlantic and Gulf coasts, into Florida and Texas; Missouri.



8. *Scirpus robustus* Pursh

Common in brackish marshes and ditches in the outer Coastal Plain of North Carolina. Extending northward into Maine and southward, along the Atlantic and Gulf coasts, into Florida and Texas; California.



9. *Scirpus cylindricus* (Torr.) Britt.

Rare in brackish tidal marshes and shores in Craven County of North Carolina. Extending, in similar habitats, northward into Maine and southward into Georgia. [*S. maritimus* γ. *cylindricus* Torr.]

10. *Scirpus longii* Fern.

Very rare in ditches in Wilson County of North Carolina. Extending northward into New England.

11. *Scirpus cyperinus* (L.) Kunth

Common in low ground, ditches, and marshes throughout North Carolina. Extending throughout the eastern half of the United States. [Includes *S. eriophorum* Michx., *S. rubricosus* Fern.]



a. var. *cyperinus*

Frequent in the Blue Ridge and Piedmont provinces of North Carolina.

b. var. *eriophorum* (Michx.) Kuntze

Common throughout North Carolina.

c. var. *pelius* Fern.

Frequent in the Blue Ridge Province of North Carolina.

12. *Scirpus expansus* Fern.

Frequent in low ground, marshes, and along streams in the Blue Ridge and inner Piedmont of North Carolina. Extending northward into Maine, southward into Georgia, and westward into Michigan, Ohio, and Tennessee. [*S. sylvaticus* L.]



13. *Scirpus georgianus* Harp.

Common in low ground, ditches, and marshes chiefly in the Blue Ridge and Piedmont provinces of North Carolina. Extending northward into New England, southward into Georgia and westward into Minnesota, Nebraska, and Texas. [*S. atrovirens* var. *georgianus* (Harp.) Fern.]



14. *Scirpus flaccidifolius* (Fern.) Schuyler

Very rare in wooded bottom-lands in Northampton County, North Carolina. Extending northward into Virginia. [*S. atrovirens* var. *flaccidifolius* Fern.]

15. *Scirpus atrovirens* Willd.

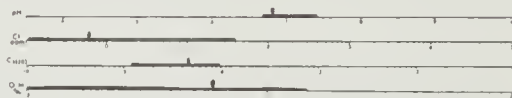
No specimens from North Carolina have been examined but this species should be present in low ground, marshes, and along streams. Extending northward into Maine, southward into Georgia and westward into Minnesota and Texas; Arizona.

16. *Scirpus hattorianus* Mak.

Rare in low ground, ditches, and marshes in Alleghany and Jackson counties of North Carolina. Extending northward into New England and westward into Minnesota, Wisconsin, Indiana, and Ohio. [*S. atrovirens* var. *georgianus* subvar. *viviparus* Farw.]

17. *Scirpus polyphyllus* Vahl

Common in low ground, swamps, marshes, and along streams in the Blue Ridge and Piedmont provinces of North Carolina. Extending northward into Massachusetts, southward into Georgia and westward into Illinois, Kentucky, Tennessee, and Alabama.



18. *Scirpus divaricatus* Ell.

Infrequent in swamps and along wooded streams in the Coastal Plain of North Carolina. Extending northward into Virginia, southward into northern Florida and westward into Tennessee, Missouri, and Louisiana.



19. *Scirpus lineatus* Michx.

Rare in swamps and along wooded streams in Craven, Jones, Onslow, and Pender counties of North Carolina. Extending northward into Virginia, southward into Florida and westward into Louisiana. [*S. fontinalis* Harp.]

20. *Scirpus pendulus* Muhl.

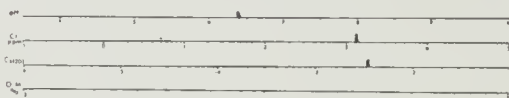
Rare in low ground, ditches, and marshes in Durham and Granville counties of North Carolina. Extending northward into Maine, southward into Florida and westward into Colorado and New Mexico; California and Oregon. [*S. lineatus* of most Am. authors, not Michx.]

## 11. ERIOPHORUM: Cotton-grass

Spikelets many-flowered, terminal, and subtended by leafy involucre bracts. Bristles numerous, silky and long-exserted.

1. *Eriophorum virginicum* L.

Infrequent in bogs and swamps chiefly in the Blue Ridge Province but also in scattered localities throughout North Carolina. Extending northward into Maine, southward into Florida and westward into Minnesota, Kentucky, and Tennessee.



SCIRPUS

ERIOPHORUM



*S. pendulus*



*S. divaricatus*



*E. virginicum*



*S. lineatus*



- a. Leaf blades long-linear, narrowly diamond-shaped in cross-section; the spathe erect, leaf-like, not enclosing the spadix, appearing as a continuation of the stem; rhizomes producing a strong, sweet odor.....1. *Acorus*
- a. Leaf blade expanded, not linear, flat; the spathe enveloping the spadix or reduced to a basal sheath, not leaf-like; spadix obviously terminal.
  - b. Blade of leaf narrowed to an obtuse to acute base; spadix long-exserted beyond the basal sheath-like spathe, golden yellow.....2. *Orontium*
  - b. Blade of leaf broadly rounded, cordate, sagittate, or hastate; spadix enclosed in a spathe.
    - c. Leaf blades sagittate or hastate; spathe green or white, elongate, not marked with purple; spadix and spathe borne on an elongate erect stem that often becomes recurved in fruit; flowers unisexual and without a calyx.....3. *Peltandra*
    - c. Leaf blades broadly rounded to cordate; spathe greenish-yellow but marked with purple streaks or spots, globose; spadix and spathe barely elevated above the substrate; flowers bisexual and with a calyx; plant foul-smelling.....4. *Symplocarpus*

1. ACORUS: *Sweetflag, Calamus*

Emerald plant of wet soil or freshwater marshy areas producing stout aromatic rhizomes from which arise linear-elongate, 2-ranked, basal leaves and simple culms each bearing one terminal, elongate, ascending spadix subtended by a leaf-like erect spathe which appears to continue the culm. The flowers are uniform.

1. *Acorus calamus* L.

Locally abundant in slightly acidic and organic water of ditches, marshes, and sluggish streams in scattered localities throughout North Carolina.

Extending northward into Maine, southward into Florida and westward into Minnesota, Nebraska, Kansas, Oklahoma, and Texas; northwestern states.



2. ORONTIUM: *Golden Club*

Emerald or floating plant of freshwater areas producing thick rhizomes deeply seated in the mud from which arise ovate to elliptic basal leaves and long-stalked, golden-yellow, cylindric spadices each subtended by a basal spathe. The lower flowers of each spadix are male, the upper female. In flower the spadices are ascending to erect, in fruit, decumbent.

1. *Orontium aquaticum* L.

Locally abundant in acidic and organic water of muddy ponds, marshes, and sluggish streams chiefly in the Coastal Plain of North Carolina. Extending northward into Massachusetts, southward into Florida and westward into New York, Pennsylvania, Kentucky, Tennessee, Mississippi, and Louisiana.



3. PELTANDRA: *Arrow-aram*

Emergent plant of freshwater marshes and shallow water, producing thick rootstocks from which arise basal petiolate leaves and long-stalked sub-globose spadices each subtended and surrounded by a thick fleshy spathe. The upper flowers on each spadix are male, the lower female. In flower, the stalks of the spadices are ascending to erect, in fruit recurved.

- a. Spathe green; leaves with several prominent lateral ribs in blade body; berry greenish or blackish.....1. *P. virginica*
- a. Spathe white; leaves without prominent lateral ribs in blade body; berry red.....2. *P. sagittaeifolia*

1. *Peltandra virginica* (L.) Kunth

Abundant throughout North Carolina except in the northern half of the Blue Ridge Province. Extending northward into Maine, southward into Florida and westward into Wisconsin, Illinois, Missouri, Arkansas, and Texas. [Includes *P. luteospadix* Fern.]



2. *Peltandra sagittaeifolia* (Michx.) Morong

Very infrequent in muddy pond and sluggish stream margins in the outer Coastal Plain of North Carolina. Extending southward into Florida; Mississippi. [*P. glauca* (Ell.) Feay]



4. SYMPLOCARPUS: *Skunk-cabbage*

Emergent plant of marshy freshwater areas producing deep-seated thick rhizomes from which arise broadly cordate, foul-smelling leaves and subglobose spadices. Each spadix, composed of uniform flowers, is subtended by a thick, fleshy spathe.

1. *Symplocarpus foetidus* (L.) Nutt.

Rare in wet meadows and swampy woodlands in the northwestern portion of the Blue Ridge and northern portion of the Piedmont of North Carolina. Extending northward into New England, southward into Georgia and westward into Ohio, Indiana, Illinois, Iowa, and Tennessee. [*Spathyema foetida* (L.) Raf.]

ACORUS ORONTIUM SYMPLOCARPUS



X 1

LEAF X  
SECTION



*O. aquaticum*

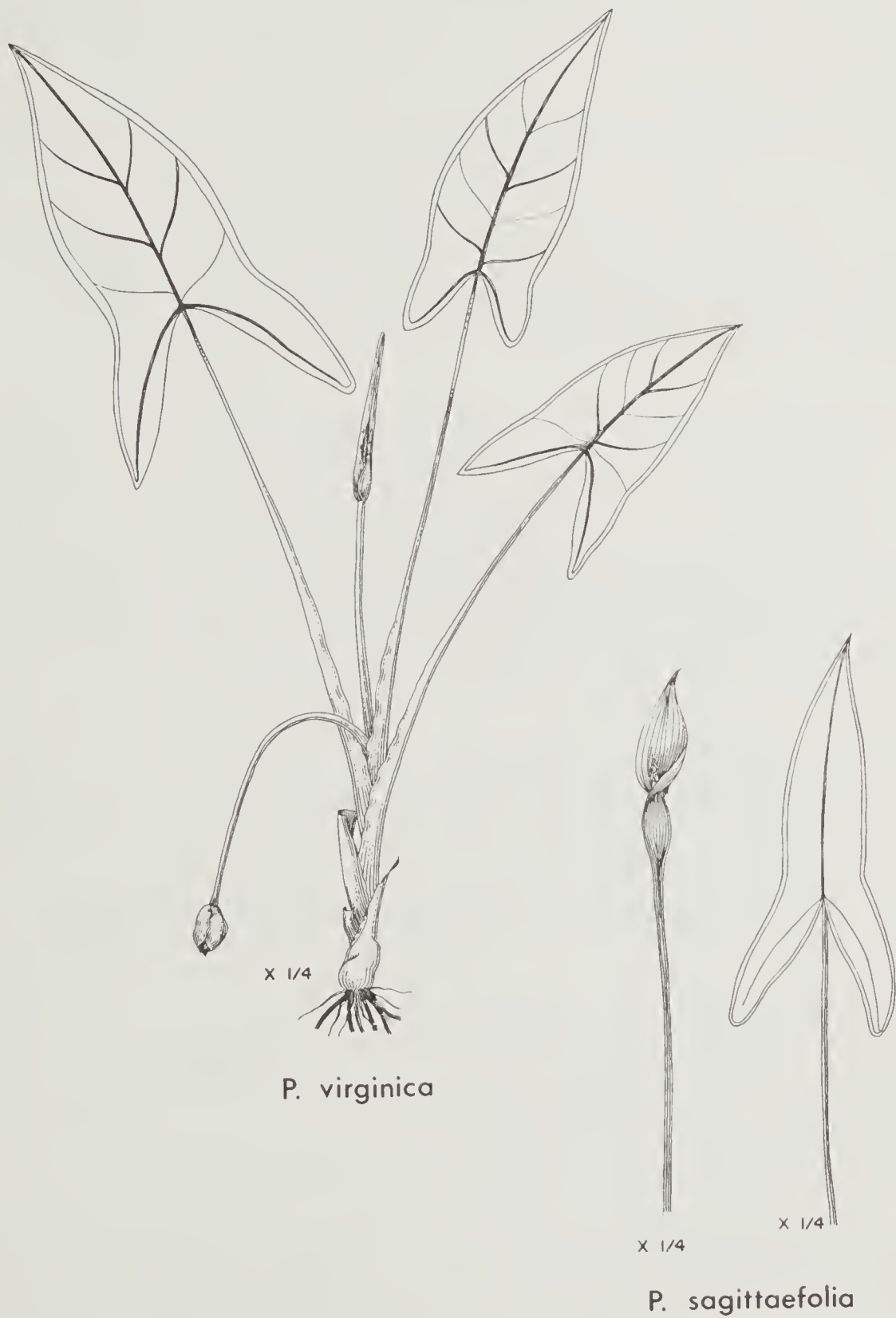


*A. calamus*



*S. foetidus*

PELTANDRA



- a. Plants with root(s) and two reproductive pouches per frond.
  - b. Roots two or more per frond.....1. *Spirodela*
  - b. Roots one per frond.....2. *Lemna*
- a. Plants without roots and with one reproductive pouch per frond.
  - c. Fronds globular or ellipsoidal.....3. *Wolffia*
  - c. Fronds sickle-shaped and elongated.....4. *Wolffiella*

# 1. SPIRODELA: Duckweed, Duck-meat, Great Duckweed

Small flattened plants floating on the water surface in freshwater areas. The frond, which is perhaps best considered to be a modified stem segment and leaf, possesses two lateral pouches. Each frond produces few-to-several roots at least one of which penetrates the prophyllum. Vegetative reproduction is extensive and seed formation relatively rare.

- a. Fronds with 2-4 roots, all of which penetrate the prophyllum.....1. *S. oligorrhiza*
- a. Fronds with 5-many roots, only one of which penetrates the prophyllum.....2. *S. polyrrhiza*

The two species of *Spirodela* that occur in North Carolina are highly responsive to environmental conditions (Ball, Beal, and Flecker, 1967; Harrison, 1964), and morphological characteristics are variable. In fact, the response of *S. oligorrhiza* to the experimental variables utilized by Harrison was more similar to that of *Lemna* than of *S. polyrrhiza*. Consequently, it may be more appropriate to consider *S. oligorrhiza* within the genus *Lemna*.

## 1. *Spirodela oligorrhiza* (Kurz) Hegelm.

Locally abundant in ponds, sloughs, and sluggish streams in widely scattered locations in the northern half of the Coastal Plain and adjacent areas of the Piedmont of North Carolina. This species is an introduction which is spreading rapidly. It is undoubtedly present throughout much of the eastern half of the United States but probably often overlooked or confused with *Lemna*.



## 2. *Spirodela polyrrhiza* (L.) Schleid., Water Flaxseed

Abundant in highly organic waters of ponds, sloughs, and sluggish streams chiefly in the Coastal Plain, except in the southwestern portion, of North Carolina. Extending throughout the United States.



# 2. LEMNA: Duckweed

Very small flattened plants floating on the water surface (in ours) in freshwater areas. The frond, as in *Spirodela*, is highly modified and possesses two pouches. Only one root is produced. The



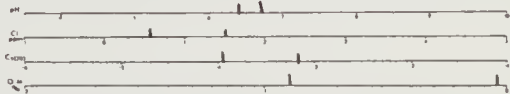
prophyllum is either absent or fused to the frond. Vegetative reproduction is extensive but some species frequently produce 3 minute flowers in a lateral pouch. Two of the flowers are male, each consisting of a single stamen, and the third is female, consisting of a single carpel. Careful examination of a *Lemna* collection will often disclose the presence of flowering fronds.

- a. Frond 3-nerved.
  - b. Lower surface of frond inflated, often purplish; nerves obscure; frond orbicular-obovate.....1. *L. gibba*
  - b. Lower surface of frond not inflated, green; nerves prominent; frond obovate to elliptical.....2. *L. perpusilla*
- a. Frond 1-nerved.
  - c. Lower surface of frond inflated, often purplish; nerve obscure; frond orbicular-obovate.....1. *L. gibba*
  - c. Lower surface of frond not inflated, light green; nerve obvious; frond elliptic-oblong to crecent-shaped...3. *L. valdiviana*

1. *Lemna gibba* L.

Locally abundant in acidic and highly organic waters of ponds, sloughs, and sluggish streams in Craven, Dare, Pasquotank, and Tyrrell counties of North Carolina. This species apparently occurs in widely scattered areas of the United States but is, perhaps, absent in the northeastern states.

According to Urbanska-Worytkiewicz (1975) and Landolt (1975) *L. gibba* does not occur in the southeastern portion of the United States. They consider these plants, the lower surface of which is inflated and often purplish, to be a form of *L. minor* L.



2. *Lemna perpusilla* Torr.

Abundant in acidic and highly organic waters of ponds, marshes, lakes, and rivers chiefly in the Coastal Plain of North Carolina. Extending throughout the eastern half of the United States.



3. *Lemna valdiviana* Phil.

Abundant in highly organic waters of ponds, marshes, lakes, and rivers in the Coastal Plain of North Carolina. Extending northward into Massachusetts, southward into Florida and westward into Michigan, Nebraska, Oklahoma, and Texas; far-western states. [*L. cyclostata* Ell. ex Thomp.]



3. WOLFFIA: Water-meal

Minute subglose plants floating at or just below the surface of water in freshwater areas. The frond is even more highly reduced than in *Spirodela* and *Lemna*, possessing no roots and only one terminal pouch. Vegetative reproduction is extensive and flower production appears to be rare.

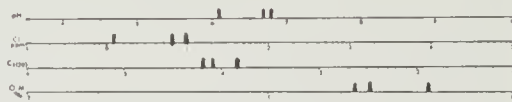
The species of *Wolffia* are difficult, if not impossible, to distinguish unless the plants are fresh or preserved in liquid. Thus, before pressing herbarium specimens, special care should be exercised in making accurate species determinations.

- a. Frond ellipsoidal-elongate, upper surface flattened and with a conspicuous papule.....1. *W. papulifera*
- a. Frond globular to ellipsoidal, upper surface not flattened and without a papule.....2. *W. columbiana*

1. *Wolffia papulifera* Thomp.

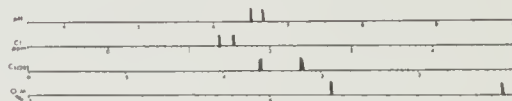
Locally abundant in ditches, sloughs, and sluggish streams in Camden, Currituck, Lenior, Northampton, Perquimans, and Wayne counties of

North Carolina. Extending northward into Virginia and westward into Illinois, Kansas, Oklahoma, Texas, Missouri, Kentucky, Tennessee, and Mississippi.



2. *Wolffia columbiana* Kars.

Locally abundant in ditches, sloughs, and sluggish streams in Dare and Perquimans counties of North Carolina. Extending throughout the eastern half of the United States.



4. WOLFFIELLA: Bog-mat, Mud-midget

Minute, elongate, flattened plants floating below the water surface in water of freshwater areas. Like *Wolffia*, the frond is highly reduced, possessing no roots and only one terminal pouch. Vegetative reproduction is extensive, the fronds frequently remaining attached in a fascicle.

Occasionally a frond produces one male flower, consisting of one stamen, and one female flower, consisting of one carpel, in a "flowering cavity" on the upper side of the frond toward the base.

1. *Wolffiella floridana* (J.D. Sm.) Thomp.

Locally abundant in slightly acidic and highly organic water of ponds, sloughs, ditches, marshes, and sluggish streams throughout the Coastal Plain of

North Carolina. Extending northward into Massachusetts, southward into Florida and westward into Missouri, Arkansas, and Texas.



--MAYACACEAE--

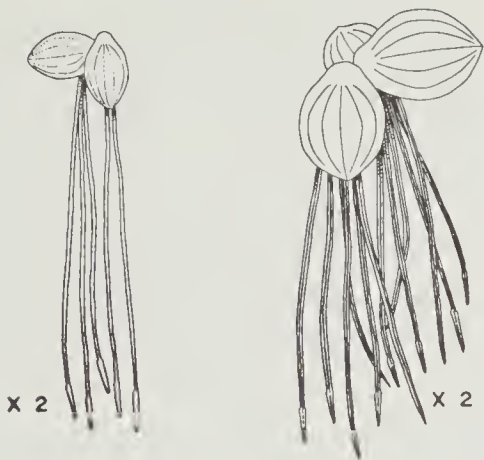
1. MAYACA: Bog Moss

Plants of wet soil or emersed to submersed in freshwater areas, with a moss-like appearance. Numerous linear leaves are spirally arranged and crowded along a simple or sparingly branched stem. The flowers are 3-merous, stalked, and solitary in the leaf axils.

It is the author's opinion that the two taxa listed below are doubtfully distinct. Experimental analyses could be accomplished easily on these plants and their taxonomic status clarified.

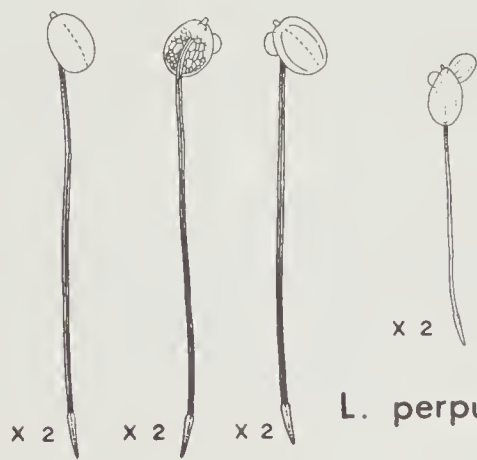
- a. Flowers borne on pedicels longer than the leaves.....1. *M. aubletii*
- a. Flowers borne on pedicels shorter than the leaves...2. *M. fluviatilis*

SPIRODELA LEMNA WOLFFIA WOLFFIELLA MAYACA



*S. oligorrhiza*

*S. polyrhiza*



*L. gibba*

*L. perpusilla*



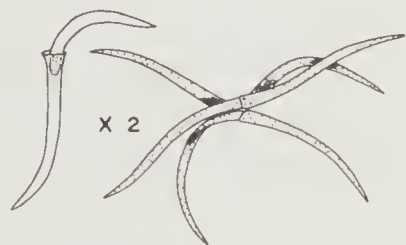
*L. valdiviana*



*Wolffia papulifera*



*Wolffia columbiana*



*Wolffiea floridana*

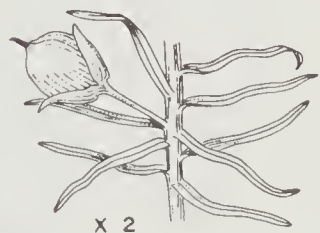


x 5

*M. aubletii*



x 1/2



x 2

*M. fluviatilis*

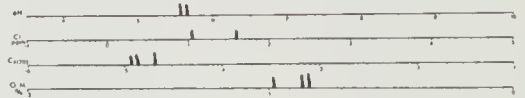
1. *Mayaca aubletii* Michx.

Locally abundant in organic but low conductance waters of ponds, lakes, marshes, and sluggish streams in the southwestern portion of the Coastal Plain and in Brunswick and New Hanover counties of North Carolina. Extending northward into Pennsylvania, southward into Florida and westward, along the Gulf states, into Texas.



2. *Mayaca fluviatilis* Aublet

Locally abundant in organic but low conductance waters of ponds, lakes marshes, and sluggish streams in Brunswick, Craven, Richmond, and Scotland counties of North Carolina. Extending southward, along the Atlantic and Gulf states, into Mississippi.



--XYRIDACEAE--

1. XYRIS: *Yellow-eyed Grass*

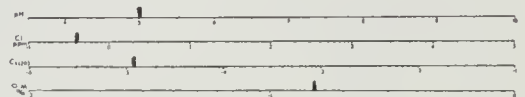
Plants of wet soil or emergent in shallow freshwater areas. The leaves are basal and the inflorescence consists of a single cone-like spike with firm, spirally-arranged scales terminating an elongated leafless stem. Each scale subtends a solitary flower with yellow petals. Two of the three sepals are lateral, keeled, and persistent. These lateral sepals provide the primary diagnostic features by which the following species are recognizable.

- a. Apices of lateral sepal keels equalling or exserted beyond the subtending bract, becoming serrate to ciliate above the middle; leaves 2-5 mm wide, flat, often becoming reddish below.....1. *X. smalliana*
- a. Apices of lateral sepal keels shorter than the subtending bract.
  - b. Keel of lateral sepals not winged, finely ciliate, with a ciliated tuft toward the apex; leaves often twisted, 2-4 mm wide.....2. *X. torta*
  - b. Keel of lateral sepals winged, the wing variously lacerate but not ciliate; leaves 3-20 mm wide.
    - c. Wing of lateral sepal keel extending the length of the sepal; leaves 6-20 mm wide, flat.....3. *X. iridifolia*
    - c. Wing of lateral sepal keel limited to the upper half of sepal; leaves 3-9 mm wide, often twisted..
      - .....4. *X. platylepis*

Several other species of *Xyris* grow in moist soil and occasionally may be found in ditches, marshes, and pond margins. Thus, if one of the following species is not clearly indicated, a more comprehensive manual should be consulted.

1. *Xyris smalliana* Nash

Infrequent in ditches, marshes, ponds, and bogs in the Sand Hills and southern half of the Coastal Plain of North Carolina. Extending north-





ward into Massachusetts and southward, along the Coastal Plain, into Florida and Louisiana.

2. *Xyris torta* Smith

Frequent in low ground, bogs, ditches, and marshes chiefly in the Blue Ridge Province of North Carolina. Widely distributed in the eastern portion of the United States except in Florida.

3. *Xyris iridifolia* Chap.

Frequent in low ground, marshes, and along stream and pond margins in the southern two-thirds of the Coastal Plain of North Carolina. Extending southward, along the Atlantic and Gulf coasts, into Florida and Texas,



4. *Xyris platylepis* Chap.

Frequent in low ground, ditches, swamps, and along ponds and streams chiefly in the Coastal Plain of North Carolina. Extending northward into eastern Virginia and southward, along the Atlantic and Gulf coasts, into Florida and Texas.



--ERIOCAULACEAE--

- a. Scapes glabrous throughout; stamens 4-6 per flower; petals each with a prominent gland.....1. *Eriocaulon*
- a. Scapes hairy, at least toward the top; stamens 2-3 per flower; petals glandless.
  - b. Perianth pubescent with thick, white hairs toward the apex; hairs enlarged toward the tip; anthers 2-celled; pubescence of stem not glandular.....2. *Lachnocaulon*
  - b. Perianth not as above; numerous silky hairs present but light brown in color and not enlarged at the tip; anthers 4-celled; stem pubescence glandular.....3. *Syngonanthus*

1. ERIOCAULON: *Pipewort*

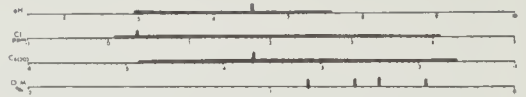
Plants of wet soil or emergent in shallow freshwater areas. Leaves basal, soft, and translucent, appearing coarsely cellular. Inflorescence a dense involucrate head of unisexual flowers terminating a leafless and glabrous, ribbed scape. Some heads contain a mixture of male and female flowers, others only male or female flowers.

- a. Scapes with 10-12 ribs; leaves 2-8 mm wide and 0.2-4 dm long.
  - b. Leaves with blunt tips, rather firm; heads firm...1. *E. decangulare*
  - b. Leaves tapering gradually to a sharp point, firm, or when submersed, thin and translucent; heads soft.. .....2. *E. compressum*
- a. Scapes with 7 or fewer ribs; leaves 1-3 mm wide and less than 1 dm long.
  - c. Involucral bracts greenish to whitish in color.....3. *E. lineare*
  - c. Involucral bracts blackish or at least black-margined.....4. *E. pellucidum*



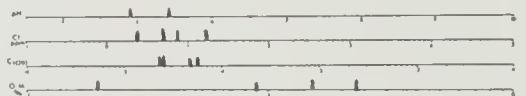
1. *Eriocaulon decangulare* L.

Common in low ground, bogs, ditches, and margins of streams and ponds throughout but less frequent in the Piedmont of North Carolina. Extending northward into eastern Pennsylvania and New Jersey and southward, along the Atlantic and Gulf coasts, into Florida and Texas.



2. *Eriocaulon compressum* Lam. (Not illustrated)

Infrequent in low ground, swamps, bogs, and ponds chiefly in the southern portion of the Coastal Plain of North Carolina. Extending northward into eastern Maryland and southward, along the Atlantic and Gulf coasts, into Florida and Texas.

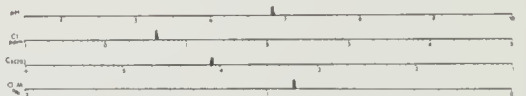


3. *Eriocaulon lineare* Small (Not illustrated)

Very rare in low ground, bogs, and pond margins in Henderson County, North Carolina. Extending southward, along the Atlantic and Gulf coasts, into Florida and Mississippi.

4. *Eriocaulon pellucidum* Michx. (Not illustrated)

Rare in ponds and stream margins in Bladen, Craven, Perquimans, Tyrrell and Washington counties of North Carolina. Extending northward into New England and westward into Minnesota, Wisconsin, Indiana, and Ohio. [E. septangulare With.]



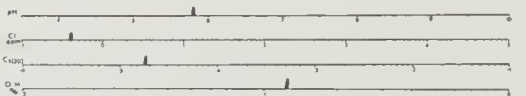
2. LACHNOCAULON: Hairy Pipewort, Bog-buttons

*Lachnocaulon* is similar to *Eriocaulon* in general habit and habitat but differs in that the scapes are pubescent, at least toward the top.

- a. Leaves gradually tapering to a blunt tip (under 10X magnification); mature heads 4.6 mm or more in diameter, globose, white to pale gray; seeds 0.6-0.8 mm long.....1. *L. anceps*
- a. Leaves gradually tapering to a pointed tip; mature heads less than 4.5 mm in diameter; seeds less than 0.6 mm long.
- b. Heads globose, gray; seeds smooth.....2. *L. beyrichianum*
- b. Heads cylindric to globose, gray to brown; seeds striated longitudinally.....3. *L. minus*

1. *Lachnocaulon anceps* (Walt.) Morong

Common in low ground, ditches, bogs, and sandy marshes chiefly in the Sand Hills and Coastal Plain of North Carolina. Extending northward into Virginia and southward, along the Atlantic and Gulf states, into Florida and Texas.



2. *Lachnocaulon beyrichianum* Sporl. (Not illustrated)

Rare in sandy pond margins in the southeastern portion of the Coastal Plain of North Carolina. Extending southward into Florida and Alabama.

3. *Lachnocaulon minus* (Chap.) Small (Not illustrated)

Infrequent in low ground, ditches, bogs, and sandy marshes in the Coastal Plain of North Carolina. Extending southward into Florida.



3. SYNGONANTHUS: *Bantam-buttons*

*Syngonanthus* is easily confused with *Eriocaulon* and especially *Lachnocaulon* since they all share the same general habitat and habit of growth. The scape of *Syngonanthus* is pubescent, like that of *Lachnocaulon*, but the pubescence is glandular. The hairs within the inflorescence are light brown, slender and silky in contrast to the white, club-shaped hairs within the inflorescence of *Lachnocaulon*.

1. *Syngonanthus flavidulus* (Michx.) Ruhl.

Rare in low ground and bogs in the southeastern portion of the Coastal Plain of North Carolina. Extending southward into Florida and Alabama.



--COMMELINACEAE--

1. ANEILEMA

Plants of wet soil or shallow freshwater areas producing prostrate stems rooting at the nodes. The leaves are alternate with closed sheaths. The flowers are terminal and/or axillary, solitary or in clusters of 2-4, with 3 sepals and 3 pink to maroon petals.

1. *Aneilema keisak* Hassk.

Abundant on pond, marsh, and stream margins chiefly in the Coastal Plain and Piedmont provinces of North Carolina. Extending northward into Virginia and southward into Georgia.



--PONTEDERIACEAE--

- a. Stamens 3; flowers regular with inconspicuous yellow, blue or rarely white petals; leaves kidney-shaped or oblong to linear.....1. *Heteranthera*
- a. Stamens 6 (3 often sterile); flowers two-lipped with conspicuous blue petals; leaves cordate or sub-orbicular to elliptical with spongy petioles that are usually inflated.
  - b. Plant usually rooted and erect; leaves without inflated petioles but with cordate bases; capsule 1-celled.....2. *Pontederia*
  - b. Plant usually free-floating; leaves in a basal rosette, usually with inflated petioles; capsule 3-celled.....3. *Eichhornia*

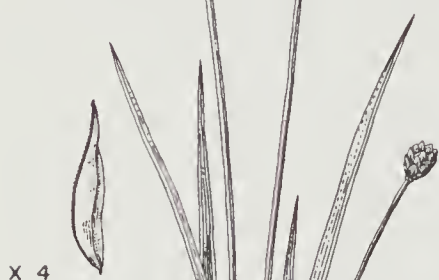
XYRIS ERIOCAULON LACHNOCAULON SYNGONANTHUS



X.  
smalliana



L. anceps



X. torta



X.  
platylepis



X. iridifolia



E. decangulare



S. flavidulus

## 1. HETERANTHERA: *Mud Plantain*

Plants creeping on wet soil or submersed to floating in fresh-water areas. The leaves are alternate and either reniform or linear-elongate. Each flower is sessile, arising from a spathe. The perianth is fused into a tube with six essentially equal lobes.

- a. Leaves kidney-shaped; petals white to pale blue.....1. *H. reniformis*
- a. Leaves oblong to linear, without cordate bases; petals light yellow.....2. *H. dubia*

### 1. *Heteranthera reniformis* R. & P.

Locally abundant in ponds, marshes, and stream margins, in the northern Coastal Plain of North Carolina. Extending northward into Connecticut, southward into Florida and westward into Nebraska, Missouri, and Texas.



### 2. *Heteranthera dubia* (Jacq.) Mac M.

Known in North Carolina only from Alleghany County. Extending throughout the eastern half of the United States; Pacific and northeastern states. [*Zosterella dubia* (Jacq.) Small]

## 2. PONTERERIA: *Pickerelweed*

Emergent plant of muddy shores and shallow freshwater areas producing thick rhizomes from which arise basal cordate leaves and erect stems bearing terminal spikes of showy, blue, zygomorphic flowers, each spike being subtended by a leaf-like spathe.

### 1. *Pontederia cordata* L.

Abundant along muddy shores and in shallow water of ponds, lakes, and streams throughout North Carolina except in the northern half of the Blue Ridge Province. Extending throughout the eastern half of the United States but chiefly in the Coastal and Great Lakes states. [Includes *P. lanceolata* Nutt.]



## 3. EICHHORNIA: *Water-hyacinth*

Free-floating plants of freshwater areas producing numerous stolons and basal leaves the petioles of which are typically inflated. The short erect inflorescence of showy, blue, zygomorphic flowers arises from a spathe.

### 1. *Eichhornia crassipes* (Mart.) Solms

Introduced and probably not surviving on an established basis in ponds in Anson and Bladen counties of North Carolina. Extending southward, along the Atlantic and Gulf states, into Texas; California. [*Piaropus crassipes* (Mart.) Britt.]





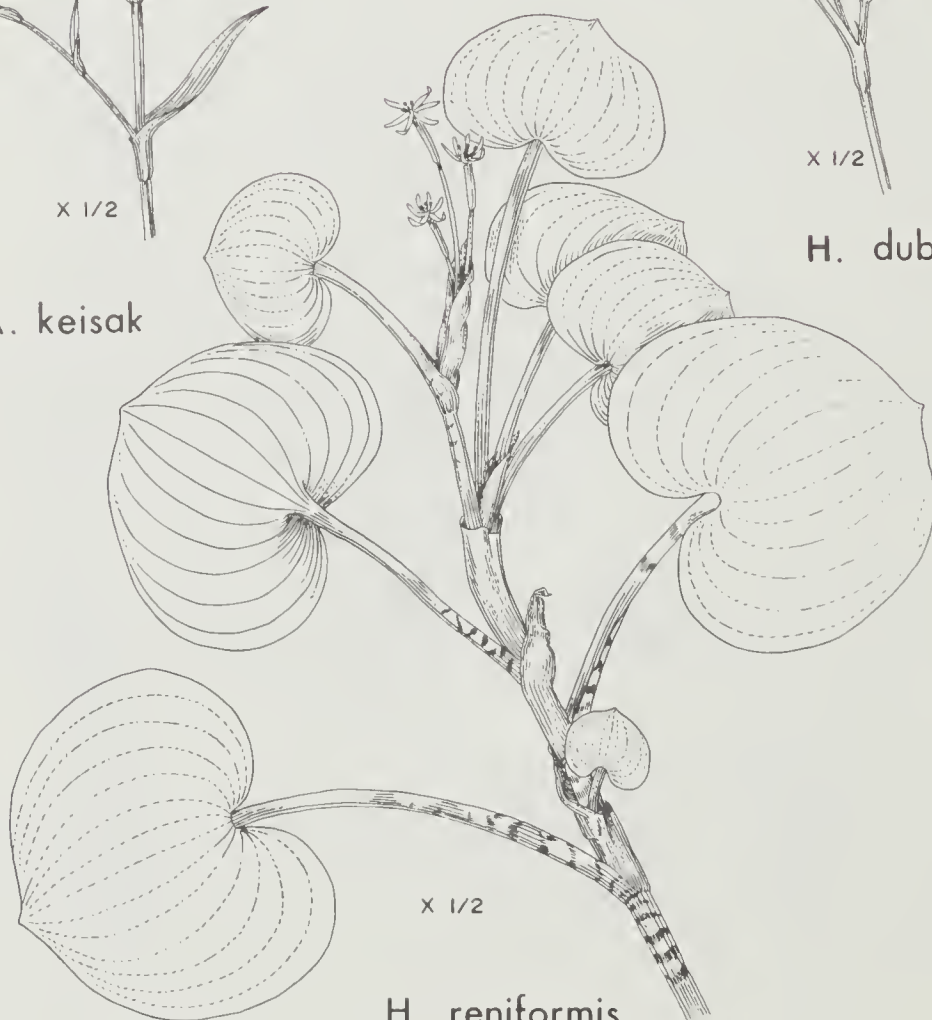
ANEILEMA HETERANTHERA



A. keisak



H. dubia



H. reniformis



PONTEDERIA

EICHHORNIA



X 1/4

*P. cordata*



X 1/4

*E. crassipes*

1. JUNCUS: Rush

Superficially the rushes appear similar to the grasses and sedges. However, observation of a flower of *Juncus* will disclose 3 sepals and 3 petals, both series being dry and scale-like, which is in direct contrast to the spikelet structure of grasses and sedges. In some species of *Juncus* the involucre bract is erect and appears to continue the stem. The inflorescence is, however, always terminal.

Identification of many species requires the presence of mature seeds. Thus, specimens of *Juncus* with only immature flowers should be avoided. For a more complete treatment of the genus *Juncus* in the Carolinas, see Batson (1952).

Except for the *J. biflorus/marginatus* complex, the species of *Juncus* seem quite distinct. None of the characters for species differentiation in the *J. biflorus/marginatus* complex is consistent and the group would provide an excellent subject for experimental studies.

- a. Inflorescence appearing lateral (resulting from the lowest involucre leaf appearing as a continuation of the stem).
  - b. The individual flowers eprophyllate--i.e., subtended by a single bractlet at the base of the pedicel; plants of brackish water.....1. *J. roemerianus*
  - b. The individual flowers prophyllate--i.e., subtended by two small bracteoles in addition to the bractlet at the base of the pedicel; plants of fresh water.
  - c. Leaves having slender, elongate, involute, channeled blades arising from the leaf sheaths....2. *J. coriaceus*
  - c. Leaves consisting of leaf sheaths and small mucronate blades.
  - d. The length of the perianth equalling that of the capsule; capsule with coriaceous or subcoriaceous walls.....3. *J. effusus*
  - d. The length of the perianth about one-half that of the capsule; capsule with thin walls.....4. *J. gymnocarpus*
- a. Inflorescence appearing terminal, the lowest involucre leaf not appearing as a continuation of the stem.
- e. Leaves nonseptate.
  - f. Flowers scattered singly in the inflorescence, prophyllate.....5. *J. bufonius*
  - f. Flowers borne in clusters of two or more, eprophyllate.
  - g. Stems weak, trailing, flattened; roots fibrous; glomerules 1-few; capsule elongate and subulate at apex.....6. *J. repens*
  - g. Stems firm, erect, rounded; roots firm; glomerules 12-200.
  - h. Rhizomes usually slender, flexuous, and cord-like; stems 1-3, mostly solitary, 0.4-1 m in height....7. *J. longii*
  - h. Rhizomes usually thick and knotty; stems numerous (rarely few), 0.15-0.6 m in height. (The following two species are probably not distinct).
  - i. Anthers mostly 0.6 mm or more in length, oblong, usually exerted beyond the sepals; glomerules usually more than 30, each 2-5 flowered.....8. *J. biflorus*

# JUNCUS



X 10



X 40



X 1/2

J. roemerianus



X 10

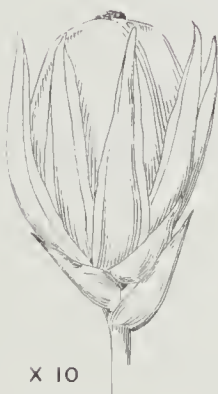


X 40



X 1/2

J. coriaceus



X 10



X 40



X 1/2

J. effusus



X 10



X 40



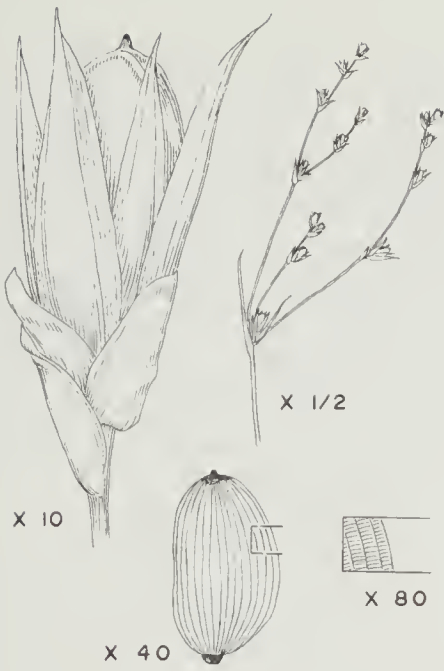
X 1/2

J. gymnocarpus

- i. Anthers 0.3-4.5 mm long; elliptical, not exerted beyond the sepals; glomerules usually less than 30, each 5-10 flowered.....9. *J. marginatus*
- e. Leaves septate.
  - j. Plants having some flowers which are aborted.
    - k. Glomerules 1-5-flowered; stamens 6.....10. *J. abortivus*
    - k. Glomerules 3-50 flowered; stamens 3.
      - l. Capsule about equalling perianth, lance-ovoid or ellipsoid.....11. *J. acuminatus*
      - l. Capsule at least one-third longer than perianth, narrowly lanceolate.....12. *J. debilis*
  - j. Plants with flowers normally developed.
    - m. Seeds having long, tail-like ends.
      - n. Capsule distinctly dark red, nearly twice the length of the spinescent perianth; plants with stiffly ascending thick branches.....13. *J. trigonocarpus*
      - n. Capsule not dark red, perianth without spines; plants not rigid.
        - o. Inflorescence elongate; capsule distinctly exerted beyond perianth; glomerules 2-few-flowered.....14. *J. brevicaudatus*
        - o. Inflorescence ovoid to broad; capsule shorter or slightly longer than the perianth; glomerules few-to-many-flowered.
          - p. The tails of the seeds two-thirds as long as the body; capsule short-pointed.....15. *J. canadensis*
          - p. The tails of the seeds one-third the length of the body; capsule tapering at the summit..  
.....16. *J. subcaudatus*
    - m. Seeds having short, pointed or blunt ends.
      - q. Flowers in dense spherical heads (hemispherical in depauperate plants); seeds pointed to blunt; perianth exceeding the length of the capsule (or, if shorter, the capsule subulate); heads never proliferating.
      - r. Capsule ovoid-conic, one-half to three-fourths the length of the perianth.....17. *J. brachycarpus*
      - r. Capsule awl-shaped, equalling or slightly exerted beyond perianth.
        - s. Leaves gladiate; valves of capsule forming a beak at the summit after dehiscence..  
.....18. *J. polycephalus*
        - s. Leaves terete.
          - t. Sheath pale green to drab; blade of uppermost leaf equalling or longer than its sheath; anthers exerted.....19. *J. scirpoides*
          - t. Sheath deep reddish-brown; blade of uppermost leaf distinctly shorter than its sheath; anthers included.....20. *J. megacephalus*
    - q. Flowers in hemispherical or narrower heads; perianth equalling or shorter than the capsule; heads sometimes proliferating.
      - u. Perianth two-fifths to one-half as long as the capsule; capsule 3.5-6 mm long.....21. *J. diffusissimus*
      - u. Perianth one-half to equalling the length of the capsule; capsule up to 3.5 mm long.



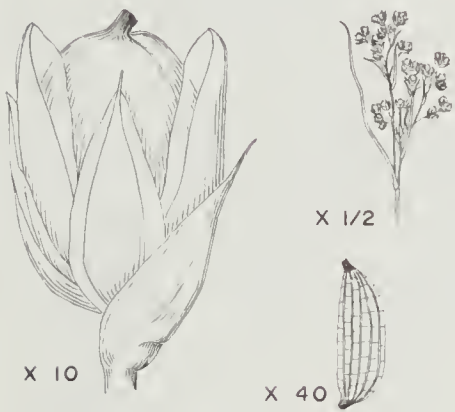
# JUNCUS



*J. bufonius*



*J. repens*



*J. biflorus* & *J. marginatus*

*J. longii*



*J. biflorus*



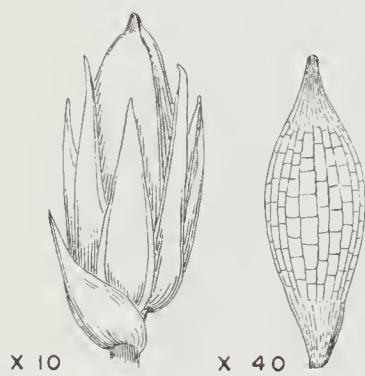
*J. marginatus*



# JUNCUS



*J. abortivus*



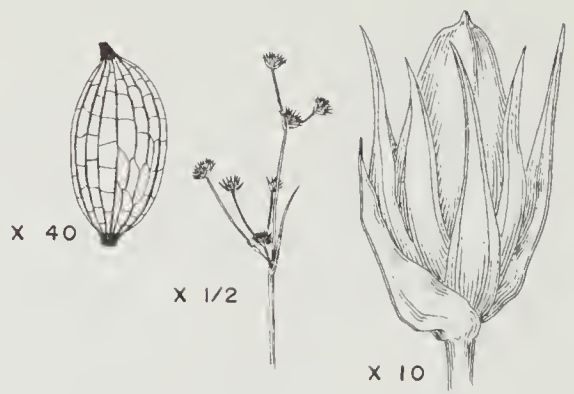
X 10

X 40



X 1/2

*J. debilis*



X 40

X 1/2

X 10

*J. acuminatus*



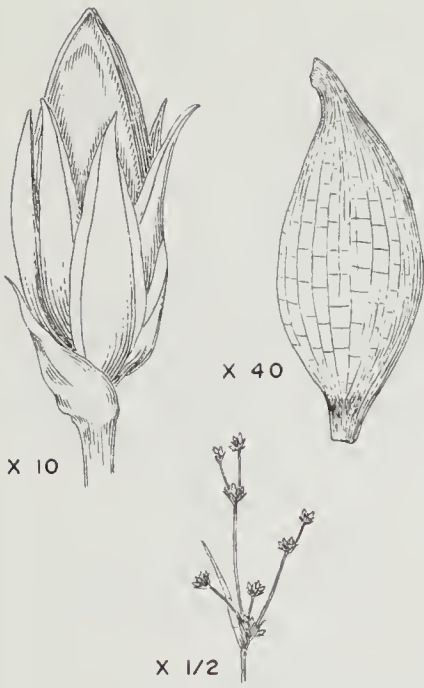
X 10

X 1/2

X 40

*J. trigonocarpus*

# JUNCUS



*J. brevicaudatus*



*J. canadensis*



*J. subcaudatus*



*J. brachycarpus*

JUNCUS



*J. polycephalus*



*J. megacephalus*



*J. scirpoides*

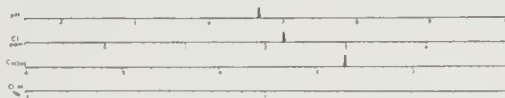


*J. diffusissimus*

- v. Heads (5)50-500; capsule 2-2.5 mm long; leaves weakly septate; heads sometimes proliferating.....22. *J. elliottii*
- v. Heads 3-50; capsule 2.5-3.5 mm long; leaves distinctly septate; heads often proliferating.
- w. Capsule about equalling perianth; lance-ovoid or ellipsoid.....11. *J. acuminatus*
- w. Capsule at least one-third longer than perianth, slenderly lanceolate.....12. *J. debilis*

1. *Juncus roemerianus* Scheele

Abundant in brackish marshes in the outer Coastal Plain of North Carolina. Extending northward into Maryland and southward, along the Atlantic and Gulf coasts, into Texas.



2. *Juncus coriaceus* Mack.

Abundant along ponds, streams, and ditches in the Coastal Plain and Piedmont provinces of North Carolina but infrequent in the extreme southwestern Blue Ridge Province. Extending northward into New Jersey, southward into Florida and westward into Kentucky, Arkansas, and Texas.



3. *Juncus effusus* L., Soft Rush

Abundant in wet soil and along ponds, streams, ditches, and marshes throughout North Carolina. Extending throughout the eastern half of the United States.



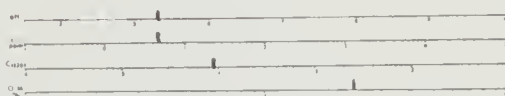
4. *Juncus gymnocarpus* Cov.

Locally abundant in acidic marshy areas of the Blue Ridge Province. Extending northward into Pennsylvania, southward into South Carolina and westward into Tennessee; Florida.



5. *Juncus bufonius* L., Toad Rush

Moist soil of roadsides, ditches, and meadows chiefly in the outer Piedmont and Coastal Plain of North Carolina. Extending essentially throughout the United States.



6. *Juncus repens* Michx.

Abundant on muddy shores and in acidic water chiefly in the Coastal Plain of North Carolina. Extending northward into Delaware and southward, along the Atlantic and Gulf states, into Texas; Arkansas, Oklahoma and Tennessee.



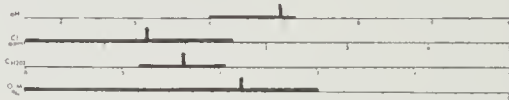


7. *Juncus longii* Fern.

Infrequent in wet clayey soils in Dare, Graham, Iredell, Union, and Wayne counties of North Carolina. Extending northward into New Jersey and Pennsylvania and southward into South Carolina; Louisiana, Arkansas, Missouri, and Oklahoma.

8. *Juncus biflorus* Ell.

Frequent in moist meadows and along pond margins chiefly in the Piedmont and Coastal Plain provinces of North Carolina. Extending northward into Massachusetts and southward, in the Atlantic and Gulf states, into Texas; Ohio, Michigan, Illinois, Missouri, and Oklahoma.



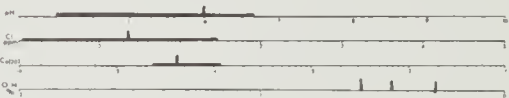
9. *Juncus marginatus* Rostk.

Abundant in moist soil throughout North Carolina. Extending throughout the eastern half of the United States; Arizona.



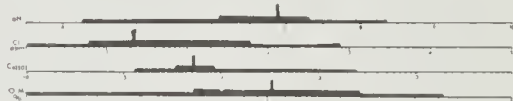
10. *Juncus abortivus* Chap.

Locally abundant in highly organic and acidic low ground and pond margins in the southern and outer Coastal Plain of North Carolina. Extending northward into Virginia and southward into Florida.



11. *Juncus acuminatus* L.

Abundant in moist soil and along pond margins throughout North Carolina. Extending throughout the eastern half of the United States; Arizona and the Pacific states.



12. *Juncus debilis* Gray

Abundant in acidic wet soils chiefly in the Coastal Plain and Blue Ridge provinces of North Carolina. Extending northward into Connecticut and Rhode Island, southward into Florida and westward into Kentucky, Missouri, Tennessee, and Texas.



13. *Juncus trigonocarpus* Steud.

Locally abundant in acidic sandy bogs chiefly in the southern half of the Coastal Plain of North Carolina. Extending southward, along the Atlantic and Gulf states, into Texas.

14. *Juncus brevicaudatus* (Engelm.) Fern.

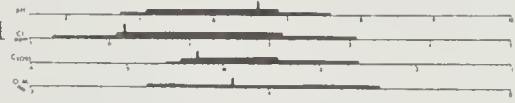
Locally abundant in wet meadows of higher elevations in the Blue Ridge Province of North Carolina. Extending from upper elevations in Tennessee and North Carolina northward into New England; Illinois, Michigan, Minnesota, and Arizona.





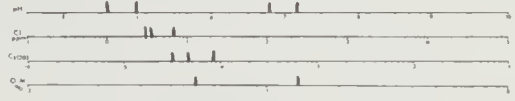
15. *Juncus canadensis* J. Gay ex La Harpe

Locally abundant in wet meadows and along pond margins chiefly in the Coastal Plain of North Carolina. Extending northward into Maine, southward, along the Atlantic states, into Georgia and westward into Minnesota, Iowa, Nebraska, Missouri, and Tennessee; Louisiana.



16. *Juncus subcaudatus* (Engelm.) Cov. & Blake

Locally abundant in wet places and pond margins in the Blue Ridge Province of North Carolina. Extending northward into Massachusetts and Connecticut, southward into Georgia and westward into West Virginia, Tennessee, and Missouri.



17. *Juncus brachycarpus* Engelm.

Locally abundant in wet sandy soil chiefly in the outer Piedmont of North Carolina. Extending northward into Massachusetts, southward into Georgia and westward into Ohio, Michigan, Indiana, Illinois, Missouri, Oklahoma, and Texas; Tennessee.



18. *Juncus polycephalus* Michx.

Locally abundant in wet soil of sandy pond margins and ditches in the Coastal Plain, except for the more northern counties, of North Carolina. Extending southward, along the Atlantic and Gulf states, into Texas.

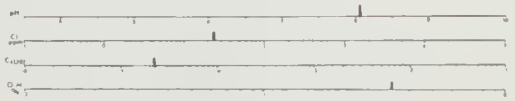
19. *Juncus scirpoides* Lam.

Abundant in moist meadows and ditches in the Piedmont and Coastal Plain provinces of North Carolina. Extending northward into New York, southward into Florida and westward into Michigan, Illinois, Missouri, Oklahoma, and Texas.



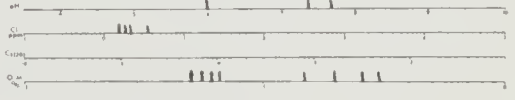
20. *Juncus megacephalus* M. S. Curtis

Locally abundant in brackish and freshwater marshes chiefly in the outer Coastal Plain of North Carolina. Extending northward into Virginia and southward, along the Atlantic and Gulf states, into Texas.



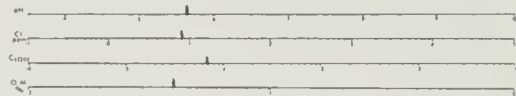
21. *Juncus diffusissimus* Buckl.

Locally abundant in wet soil of meadows and pond margins chiefly in the Coastal Plain of North Carolina. Extending northward into Virginia, southward into Georgia and westward into Indiana, Kentucky, Missouri, Kansas, and Texas.



22. *Juncus elliotii* Chap.

Locally abundant in wet soil of meadows and pond margins chiefly in the Coastal Plain of North Carolina. Extending northward into Delaware, southward, along the Atlantic and Gulf states, into Texas and westward into Tennessee.



--AMARYLLIDACEAE--

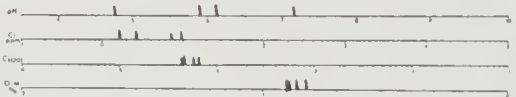
1. HYMENOCALLIS: *Spider-lily*

Erect plants of wet soil or shallow freshwater areas producing deep-seated bulbs from which arise linear-elongate basal leaves and long leafless stems each bearing a terminal umbel of large white flowers in which the stamens are united into a white, membranous, flaring tube.

- a. Flowers 2 or 3 together; plant of the Coastal Plain.. 1. *H. crassifolia*
- a. Flowers several, mostly 4-6, in a cluster; plant of more inland areas.....2. *H. occidentalis*

1. *Hymenocallis crassifolia* Herb.

Very local in slightly brackish and organic waters of marshes and muddy stream margins in the southeastern portion of the Coastal Plain of North Carolina. Extending southward, along the Coastal Plain, into Florida and Alabama. [*H. cornaria* (Le Conte) Kunth]



2. *Hymenocallis occidentalis* (Le Conte) Kunth (Not illustrated)

Rare on rocky river shoals and marshy stream banks in McDowell County, North Carolina. Extending southward into Florida and westward into Illinois, Missouri, and Mississippi.

--IRIDACEAE--

1. IRIS: *Iris*, *Flag*

Erect plants of wet soil or shallow freshwater areas producing stout rhizomes (in ours) from which arise sword-like leaves and stems each bearing one-several large, showy, regular, 3-merous flowers. The ovary is inferior.

- a. Perianth yellow.....1. *I. pseudoacorus*
- a. Perianth blue, purple or white.
  - b. Leaves mostly less than 1 cm wide.....2. *I. prismatica*
  - b. Leaves more than 1 cm wide; main bract of the involucre much shorter than the flower; hypanthium 3-angled; stigma unlobed.....3. *I. virginica*

JUNCUS HYMENOCALLIS



X 40



X 10



X 1/2

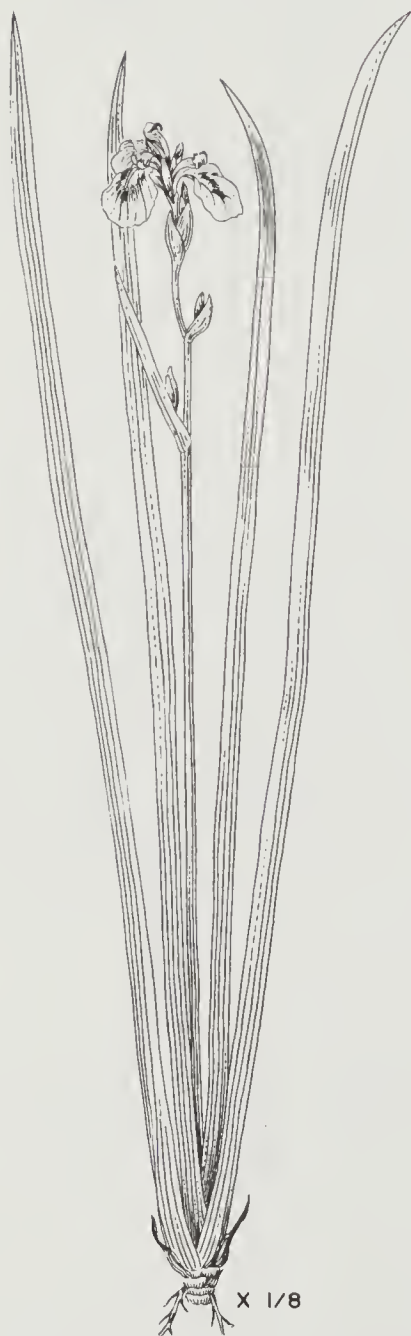
*J. elliotii*



X 1/4

*H. crassifolia*

IRIS    HABENARIA



*I. pseudoacorus*



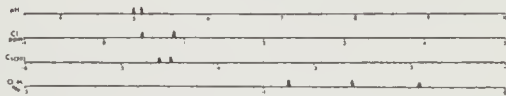
*H. repens*

1. *Iris pseudoacorus* L., *Yellow Flag*

Infrequent in shallow water of marshes, swamps, and stream margins of scattered localities throughout North Carolina. Introduced from Europe and now established throughout much of the northeastern quarter of the United States; Texas.

2. *Iris prismatica* Pursh *ex* Ker. (Not illustrated)

Infrequent in shallow water of ditches, marshes, and bogs chiefly in the Coastal Plain of North Carolina. Extending northward into Maine, southward into Georgia and westward into Kentucky and Tennessee.



3. *Iris virginica* L., *Blue Flag* (Not illustrated)

Frequent in shallow water of marshes, swamps, and along stream and pond margins throughout the Coastal Plain and Blue Ridge provinces but infrequent in the Piedmont of North Carolina. Extending northward into Virginia, southward into Florida and westward into West Virginia, Tennessee, and Texas.



--ORCHIDACEAE--

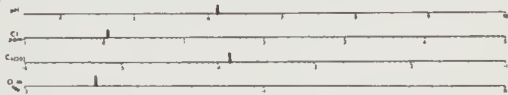
1. HABENARIA

Emergent freshwater plants with leafy stems producing small zygomorphic flowers with inferior ovaries in a terminal raceme. The only species included herein has greenish flowers.

Numerous species of *Habenaria*, and of other orchid genera as well, grow in moist soil or boggy areas. A more inclusive manual should be consulted if the following species is not clearly indicated.

1. *Habenaria repens* Nutt., *Water-spider Orchid*

Infrequent in shallow water of marshes, swamps, ditches, and pond margins chiefly in the southern portion of the Coastal Plain of North Carolina. Extending southward, in the Coastal Plain, into Florida and Texas.



--SAURURACEAE--

1. SAURURUS: *Lizard's-tail*

Plants of wet soil or shallow freshwater areas producing rhizomes and erect, pubescent, branched stems with alternate leaves and long, ascending racemes opposite the leaves. The racemes are whitish in flower and usually drooping toward the tip.

1. *Saururus cernuus* L.

Abundant in shallow water of marshes and swamps as well as along stream and pond margins throughout the Piedmont and Coastal Plain provinces of North Carolina. Extending throughout the eastern half of the United States except for the northern portion of the New England states.





--SALICACEAE--

1. SALIX: Willow

Trees or shrubs of wet soil and shallow freshwater areas with alternate serrate leaves and producing flowers, either male or female, in elongate catkins on separate plants. Both male and female flowers lack a perianth.

Several species of *Salix* grow in low areas and a more comprehensive manual should be consulted if the following species is not clearly indicated.

1. *Salix sericea* Marsh., Silky Willow

Frequent in low areas or shallow water of swamps, marshes, ditches, and stream margins throughout North Carolina except in the southern portion of the Coastal Plain. Extending northward into New England, southward into Georgia and westward into Michigan, Iowa, Missouri and Tennessee.

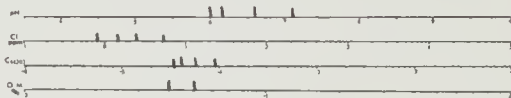
--MYRICACEAE--

1. MYRICA

Shrubs or small trees of wet soil or shallow freshwater areas producing alternate leaves, serrate toward the tip, and either male or female flowers in subglobose catkins. The leaves are thick, heavily sprinkled with resinous dots on both surfaces, and usually pubescent.

1. *Myrica cerifera* L., Wax Myrtle

Abundant in low ground and marshes chiefly in the Coastal Plain of North Carolina. Extending northward into New Jersey, southward into Florida and westward into Arkansas and Texas. [*Cerothamnus ceriferus* (L.) Small]



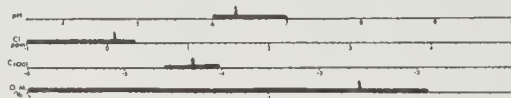
--BETULACEAE--

1. ALNUS: Alder

Shrubs or small trees of wet soil or shallow water with alternate, widely ovate to obovate, serrate leaves and producing male and female flowers in catkins. The male catkins, which are produced in the fall but flower the following spring, are narrowly cylindric and herbaceous. The female catkins are broadly cylindric to ovoid and woody.

1. *Alnus serrulata* (Ait.) Willd.

Common in low ground and shallow water of marshes, ditches, stream margins, and along pond margins throughout North Carolina. Extending northward into Maine, southward into Florida and westward into New York, Ohio, Missouri, Oklahoma, and Texas.



SAURURUS SALIX MYRICA ALNUS



Sau. cernuus



Sal. sericea



M. cerifera



A. serrulata

--URTICACEAE--

- a. Flowers in axillary spikes; nutlet completely enclosed by the fused calyx; stem not translucent.....1. *Boehmeria*
- a. Flowers in axillary panicles or glomerules; nutlet exceeding the calyx; stem translucent.....2. *Pilea*

1. BOEHMERIA: False Nettle

Plants of wet soil or shallow freshwater areas with opposite, serrate leaves (in ours) on an erect stem. Flowers, both male and female, are without petals and are clustered in small heads along leafless sections of lateral branches.

1. *Boehmeria cylindrica* (L.) Swartz

Common in low ground, marshes, stream margins, and boggy pond margins throughout North Carolina. Extending throughout the eastern half of the United States.



2. PILEA: Clearweed

Small plants of wet soil or shallow freshwater areas with opposite, serrate leaves on an erect, translucent stem. Flowers, both male and female, are without petals and in 1-sided axillary inflorescences.

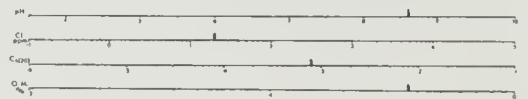
- a. Fruit dark olive to black, the margin colorless, about as long as broad, with a roughened surface; petioles one-fifth to one-half length of blade.....1. *P. fontana*
- a. Fruit straw-colored to green, often marked with black, the margins not paler, longer than broad, with a smooth surface; petioles one-third to equalling the blade.....2. *P. pumila*

1. *Pilea fontana* (Lunell) Rydb.

Infrequent but locally abundant in low marshy areas in the Coastal Plain of North Carolina. Extending northward into western New York, southward into Florida and westward into South Dakota and Nebraska.

2. *Pilea pumila* (L.) Gray

Abundant throughout North Carolina except infrequent in the southern half of the Coastal Plain. Extending throughout the eastern half of the United States. [*Adicea pumila* (L.) Raf.]



--POLYGONACEAE--

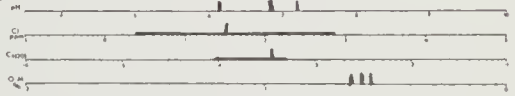
- a. Flowers distinctly pedicelled, in axillary whorls; sepals 6, the inner becoming enlarged and enclosing the fruit; sepals with distinct grains.....1. *Rumex*
- a. Flowers sessile or short-pedicelled in spikes or racemes; sepals 5, all alike, often petaloid; no grains present on the sepals.....2. *Polygonum*

## 1. RUMEX: Dock

Erect plants of moist soil or shallow fresh to slightly brackish water with alternate leaves, tubular sheaths (ocrea), enlarged nodes and flowers without petals. Of the 6 sepals the 3 inner sepals become enlarged, each bearing a large grain or tubercle.

### 1. *Rumex verticillatus* L., Swamp Dock

Frequent in low ground, swamps, marshes, and along stream margins chiefly in the outer half of the Coastal Plain of North Carolina but infrequent elsewhere. Extending throughout the eastern half of the United States except for the upper New England states. [*R. floridanus* Meissner]



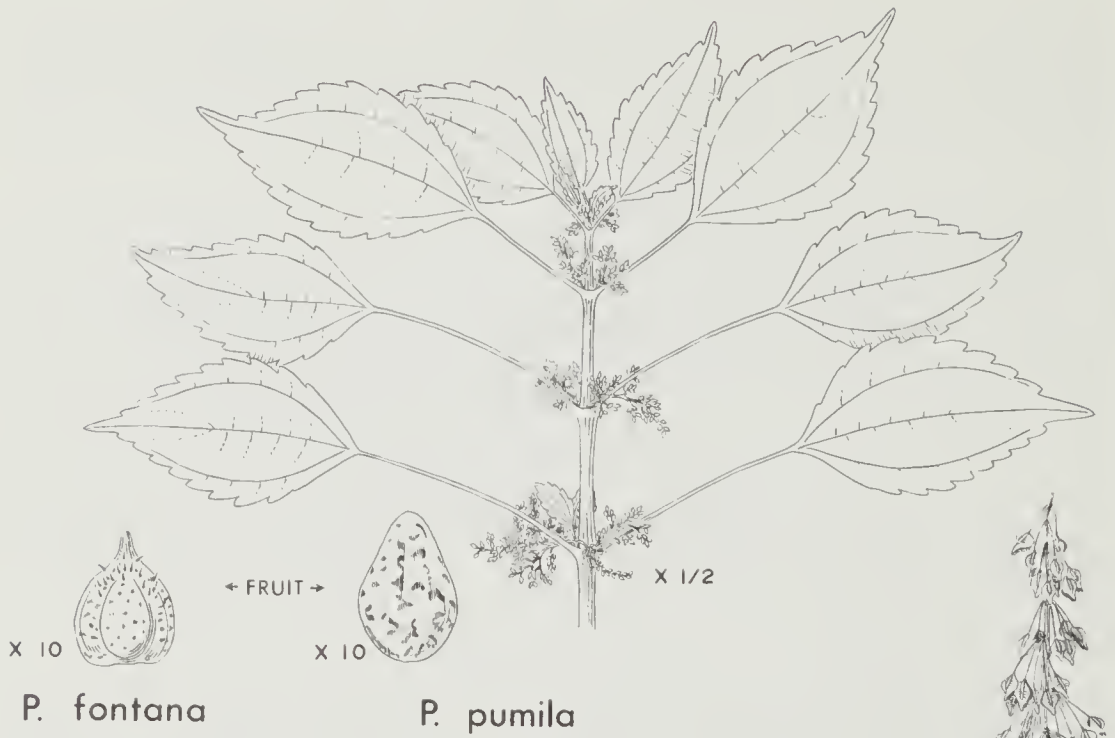
## 2. POLYGONUM: Smartweed, Knotweed

Erect, lax, procumbent or climbing plants of wet soil or shallow freshwater areas with alternate leaves, tubular sheaths (ocrea), enlarged nodes and flowers without petals. The sepals, usually 5 in number, are greenish, white, pink or red and are, in some species, dotted with glands.

Most of the following species exhibit rather well-defined features. *Polygonum amphibium*, however, exhibits a wide range of morphological variability which is often correlated with habitat. Mitchell (1968) has provided an excellent summary of variability in the *P. amphibium* complex (including *P. coccineum* and *P. natans* as well as *P. amphibium*) from both the descriptive and experimental points of view.

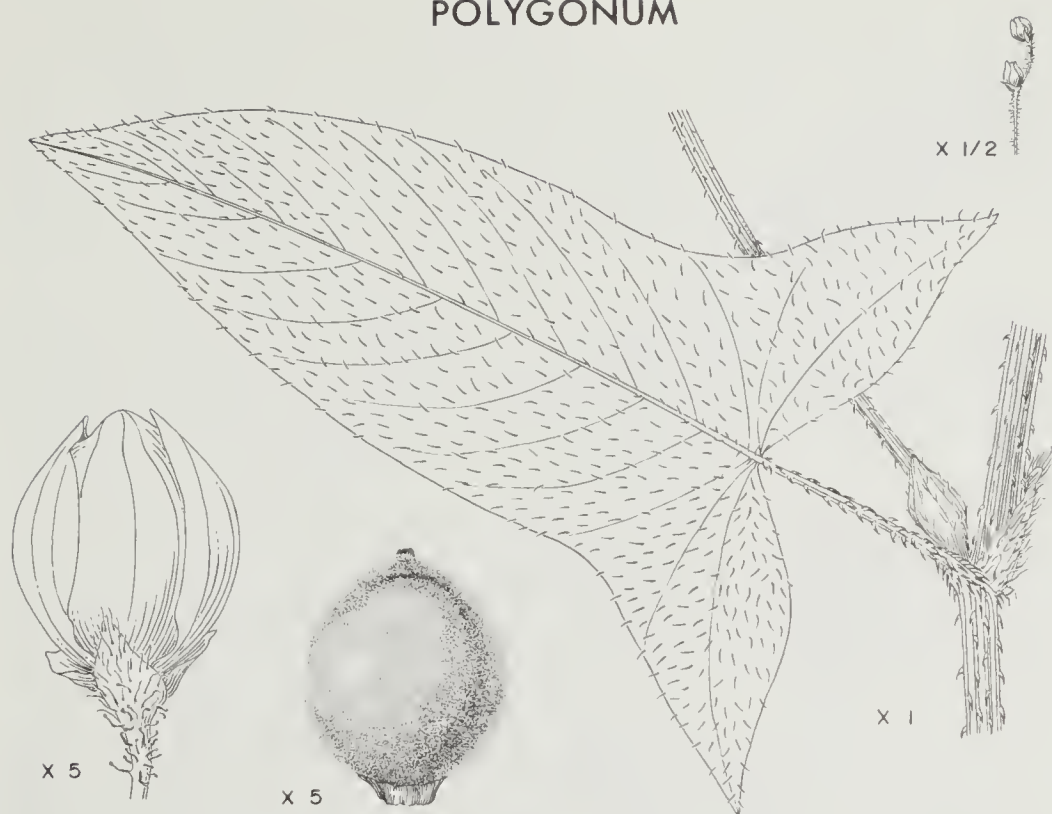
- a. Stem retrorsely barbed.
  - b. Leaves hastate, inflorescence racemose; nutlets lenticular.....1. *P. arifolium*
  - b. Leaves sagittate, inflorescence capitate; nutlets trigonous.....2. *P. sagittatum*
- a. Stems not barbed.
  - c. Ocrea entire or merely lacerate.
    - d. Raceme solitary, rarely paired, terminal; flowers normally scarlet to pink.....3. *P. amphibium*
    - d. Racemes numerous, terminal and axillary; flowers pale to deep pink.....4. *P. densiflorum*
  - c. Ocrea with bristles or cilia.
    - e. Calyx not obviously glandular punctate.
      - f. Stem and ocrea long-hirsute; leaf bases slightly cordate.....5. *P. hirsutum*
      - f. Stem glabrous to strigose; ocrea strigose; leaf tapering to a cuneate base.....6. *P. hydropiperoides*
    - e. Calyx glandular punctate.
      - g. Glands whitish, confined to the inner lobes of the calyx.....6. *P. hydropiperoides*
      - g. Glands rose colored, distributed on the tube and lobes of the calyx, often most abundant toward the base.....7. *P. punctatum*

BOEHMERIA    PILEA    RUMEX

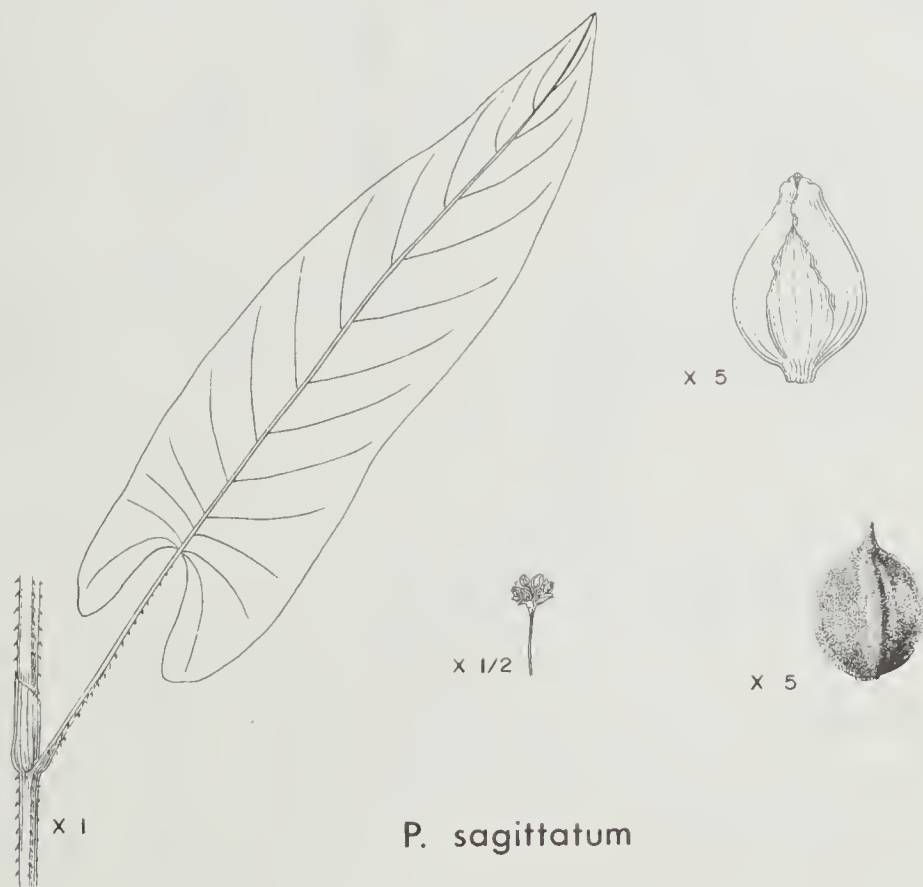




# POLYGONUM

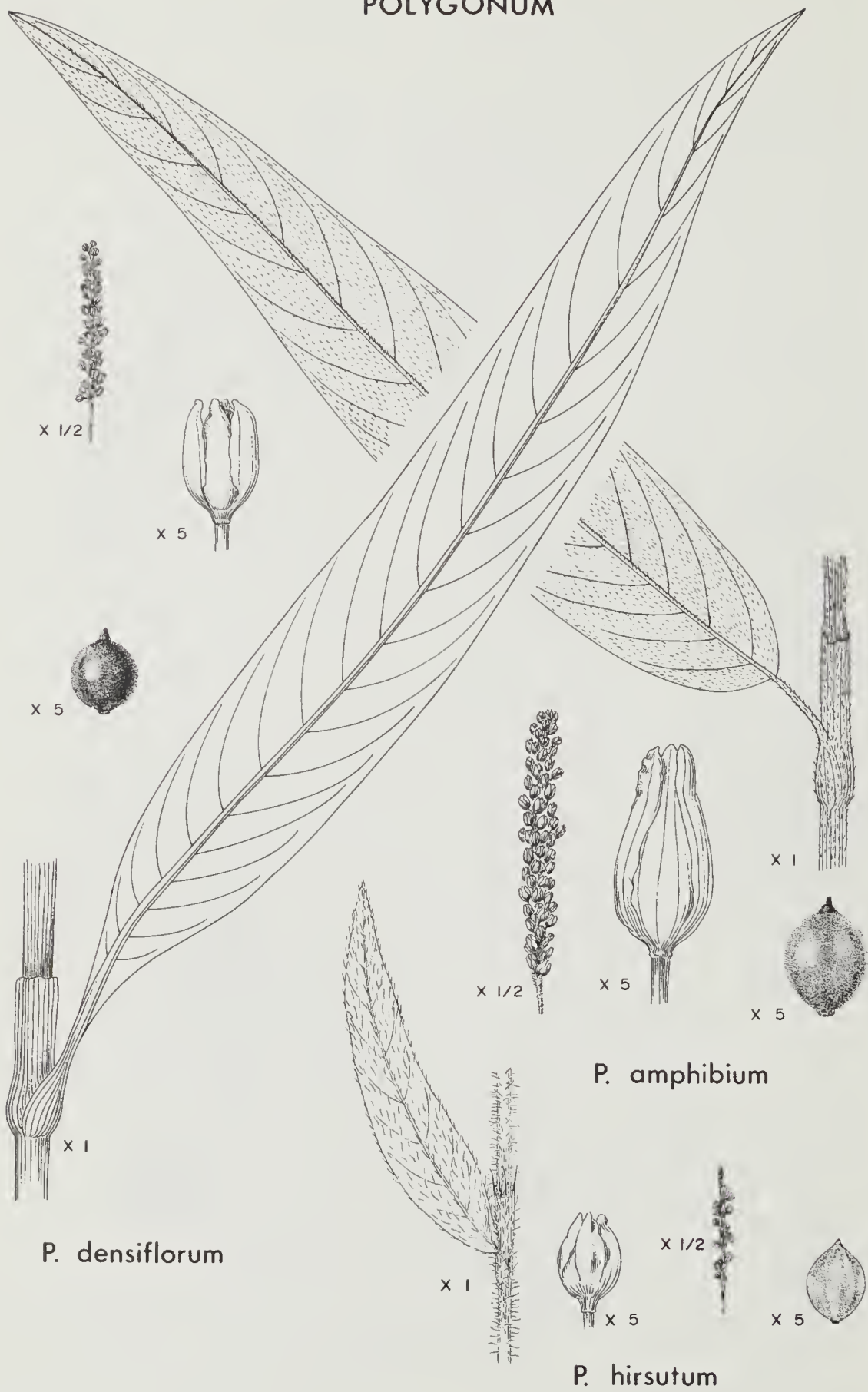


*P. arifolium*



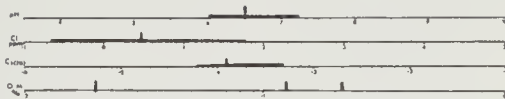
*P. sagittatum*

POLYGONUM



1. *Polygonum arifolium* L., Tearthumb

Frequent in moist soil, ditches, and marshes of the central and northern portions of the outer Coastal Plain but infrequent elsewhere in the Coastal Plain and Piedmont provinces of North Carolina. Extending northward into the New England states, southward into Florida and westward into Minnesota and Missouri. [*Tracaulon arifolium* (L.) Raf.]



2. *Polygonum sagittatum* L., Tearthumb

Abundant in ditches, marshes, and low ground throughout North Carolina. Extending throughout the United States east of the Rocky Mountains. [*Tracaulon sagittatum* (L.) Small]

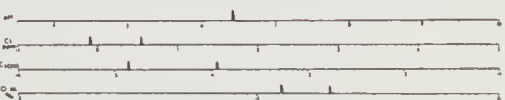


3. *Polygonum amphibium* L.

Locally abundant in marshy areas in Avery, Halifax, and Person counties of North Carolina. Extending northward into Maine, southward into South Carolina and westward into Washington and California. [*P. coccineum* Muhl. ex Willd., *Persicaria muhlenbergii* (Meissner) Small]

4. *Polygonum densiflorum* Meissner

Infrequent in swamps and marshes in the Piedmont and Coastal Plain provinces of North Carolina. Extending, along the Coastal Plain, into New Jersey, southward into Florida, westward into Texas and thence northward into Missouri. [*Persicaria portoricensis* (Bert.) Small]



5. *Polygonum hirsutum* Walt.

Rare in ditches and along stream and pond margins of Onslow County, North Carolina. Extending southward into Florida. [*Persicaria hirsuta* (Walt.) Small]



6. *Polygonum hydropiperoides* Michx.

Abundant in low ground and shallow water of swamps, marshes, and along streams and pond margins chiefly in the Coastal Plain of North Carolina. Extending throughout the United States.



7. *Polygonum punctatum* Ell.

Abundant in low ground and shallow water of marshes and along stream and pond margins throughout North Carolina. Extending throughout the United States. [*Persicaria punctata* (Ell.) Small]



--CHENOPODIACEAE--

- a. Leaves more than 5 mm wide, toothed or lobed; calyx absent; fruit covered by two broad bracteoles.....1. *Atriplex*

- a. Leaves less than 5 mm wide, entire or reduced to non-foliaceous scales; fruit covered by calyx lobes.
- b. Stem fleshy; leaves all opposite and reduced to scales; flowers in threes, imbedded in the fleshy stem immediately above the leaf scales.....2. *Salicornia*
- b. Stem scarcely fleshy; leaves alternate and opposite on the same plant, foliaceous but fleshy, narrowly linear; flowers in a terminal panicle.....3. *Suaeda*

# 1. ATRIPLEX: *Orach*

Erect to prostrate plants of wet soil or shallow brackish water with leaves usually opposite below and alternate above. Flowers, both male and female, usually mixed together in terminal and/or axillary spikes. Fruit enclosed in a pair of small, persistent, triangular bracts.

## 1. *Atriplex patula* L.

Infrequent in brackish or alkaline marshes chiefly in the outer Coastal Plain of North Carolina. Widespread throughout most of the United States in saline or alkaline areas.



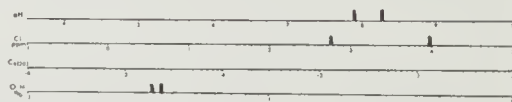
# 2. SALICORNIA: *Glasswort*

Erect or procumbent fleshy, but internally often woody, plants of salt flats and brackish marshes with small, scale-like, opposite leaves. Flowers are produced in threes, imbedded in the succulent stem above the scale-like leaves.

- a. Main stem horizontal, freely branching in the sand with numerous upright branches; central flower in each axil only slightly higher than the two lateral flowers; perennial.....1. *S. virginica*
- a. Main stem erect; central flower in each leaf axil conspicuously higher than the two lateral flowers; annual.
- b. Leaf scales sharply pointed and conspicuous.....2. *S. bigelovii*
- b. Leaf scales blunt to obtuse.....3. *S. europaea*

## 1. *Salicornia virginica* L., *Perennial Saltwort*

Locally abundant in brackish marshes and salt flats in the outer Coastal Plain of North Carolina. Extending throughout the Atlantic, Gulf, and Pacific coasts in suitable areas. [*S. perennis* Miller]



## 2. *Salicornia bigelovii* Torr., *Dwarf Saltwort*

Locally abundant in brackish marshes and salt flats in the outer Coastal Plain of North Carolina. Extending, along the Atlantic and Gulf coasts, from Maine to Texas; California.

POLYGONUM ATRIPLEX SALICORNIA



P. hydropiperoides



A. patula

S. europaea





### 3. *Salicornia europaea* L., Pigeon-foot

Locally abundant in brackish marshes and salt flats in the outer Coastal Plain of North Carolina. Extending throughout the Atlantic and Pacific coasts in suitable areas; inland in saline areas of New York, Michigan, Wisconsin and Illinois.



### 3. SUAEDA: Sea-blite

Erect plants of moist soil or brackish marshes with fleshy, linear, alternate leaves. The flowers are in terminal and axillary spikes. The 5 sepals are fused at the base, persistent, and enclose the fruit.

#### 1. *Suaeda linearis* (Ell.) Moq.

Locally abundant in moist sand and brackish marshes in the outer Coastal Plain of North Carolina. Extending throughout the Atlantic and Gulf coasts in suitable areas. [*Dondia linearis* (Ell.) Millsp.]

### --AMARANTHACEAE--

- a. Leaves opposite.....1. *Alternanthera*
- a. Leaves alternate.....2. *Amaranthus*

#### 1. ALTERNANTHERA

Procumbent plants of wet soil or shallow freshwater areas which root at the nodes and often form dense mats. Leaves are elliptic to oblanceolate, opposite, and entire. Flowers are white, without petals, and borne in spikes arising from the upper leaves of an erect to ascending stem.

It appears that *Alternanthera* has invaded the eastern portion of the Coastal Plain of North Carolina in recent years. Due to its persistence in a wide variety of habitats it is a weedy pest in some agricultural areas.

#### 1. *Alternanthera philoxeroides* (Mart.) Griseb., Alligator-weed

Locally abundant in wet, marshy soil or in aquatic habitats chiefly in the outer half of the Coastal Plain of North Carolina. Extending southward,

in the Coastal Plain, into Florida and Texas. An introduction from South America that has become a weedy pest. [*Achyranthes philoxeroides* (Mart.) Stand.]

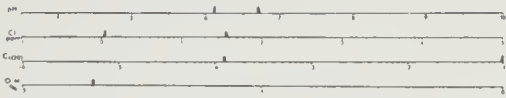


#### 2. AMARANTHUS: Amaranth

Robust erect plants of wet soil and shallow, brackish water with alternate, entire leaves. The flowers are unisexual, on separate plants, and borne in large terminal panicles of numerous spikes. The male inflorescences usually are leafless while the female inflorescences usually contain several leafy bracts.

1. *Amaranthus cannabinus* (L.) J.D. Sauer, *Water-hemp*

Frequent in brackish marshes in the outer Coastal Plain of North Carolina. Extending, along the Atlantic Coast, northward into Maine and southward into Florida. [*Acnida cannabina* L.]



--CARYOPHYLLACEAE--

- a. Stipules present; plants of salt marshes and tidal flats..
- .....1. *Spergularia*
- a. Stipules not present; plants of freshwater areas.....2. *Stellaria*

1. SPERGULARIA: *Sand Spurrey*

Small tufted plants of tidal flats and salt marshes with opposite, linear leaves and deltoid stipules. The flowers are rather small and inconspicuous with 5 glandular-stipitate sepals, 5 white to pink petals, and 2-5 stamens.

1. *Spergularia marina* (L.) Griseb.

Infrequent in tidal flats and salt marshes in the outer Coastal Plain of North Carolina. Extending throughout the Atlantic, Gulf, and Pacific coasts in suitable areas; alkaline soils of the interior. [*S. salina* J. & C. Presl, *Tissa marina* (L.) Britt.]

2. STELLARIA: *Chickweed*

1. *Stellaria aquatica* (L.) Scop.

Rare in marshes and along stream beds in Avery County, North Carolina. A native of Europe that has been introduced into the United States chiefly in the northeastern and upper midwestern states. [*Myosoton aquaticum* (L.) Moench]

--CERATOPHYLLACEAE--

1. CERATOPHYLLUM: *Hornwort*

- a. Fruit with two basal spines and a persistent apical style; leaf divisions usually firm and rough to the touch, with distinct marginal serrations; leaf bases not inflated..1. *C. demersum*
- a. Fruit as above but with additional lateral spines; leaf divisions flaccid and barely, if at all, rough to the touch, serrations, when present, obscure and delicately spinulose; leaf bases sometimes inflated.....2. *C. echinatum*

1. *Ceratophyllum demersum* L.

Locally abundant in ditches, pools, and sluggish streams chiefly in the outer Coastal Plain of North Carolina. Extending throughout the United States.



This is a very highly variable species with chemical and physical characteristics of the habitat appearing to be responsible for that variability. However, genetic factors may also be involved. Experimental studies easily could clarify the basis of the extensive morphological variability.

SUAEDA ALTERNANTHERA AMARANTHUS  
SPERGULARIA STELLARIA



X 1.5

Su. linearis



X 1/2

Al. philoxeroides



X 1/2

Am. cannabinus



X 1/4

St. aquatica

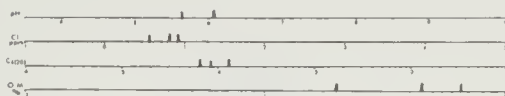


X 1

Sp. marina

2. *Ceratophyllum echinatum* Gray

Infrequent in ditches, pools, and sluggish streams in the outer Coastal Plain of North Carolina. Extending northward into southern Maine, southward into Florida and westward into Minnesota, Iowa, Missouri, Arkansas, and Texas.



--NYMPHAEACEAE--

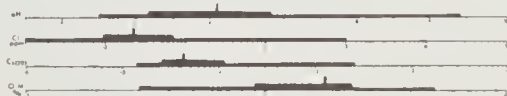
- a. Leaves with palmate venation and pointed basal lobes; flowers white (occasionally pinkish) or yellow; sepals green; petals conspicuous, numerous, grading into stamens; carpels united at the base and extending upward into slender carpellary styles.....1. *Nymphaea*
- a. Leaves with pinnate venation and rounded basal lobes; flowers with greenish-yellow sepals which may have red or purple markings; petals yellow and inconspicuous, stamen-like; carpels completely united, the stigmas radiate and sessile on a disc.....2. *Nuphar*

1. NYMPHAEA: *Water-lily*

- a. Petals white or occasionally pinkish.....1. *N. odorata*
- a. Petals yellow.....2. *N. mexicana*

1. *Nymphaea odorata* Ait.

Common in ditches, ponds, lakes, swamps, and sluggish streams throughout North Carolina. Extending northward into Maine, southward into Florida and westward into Minnesota, Iowa, Kansas, Oklahoma, Texas, and Arizona.



This species is probably not distinct from *N. tuberosa* Paine. However, experimental studies are needed to clarify that point. [*Castalia minor* (Sims) DC., *Castalia odorata* (Ait.) Woodv.]

2. *Nymphaea mexicana* Zucc. (Not illustrated)

Introduced into Johnston and Perquimans counties of North Carolina. Extending southward into Florida and westward into Texas and Arizona. [*Castalia flava* (Leit.) Greene]

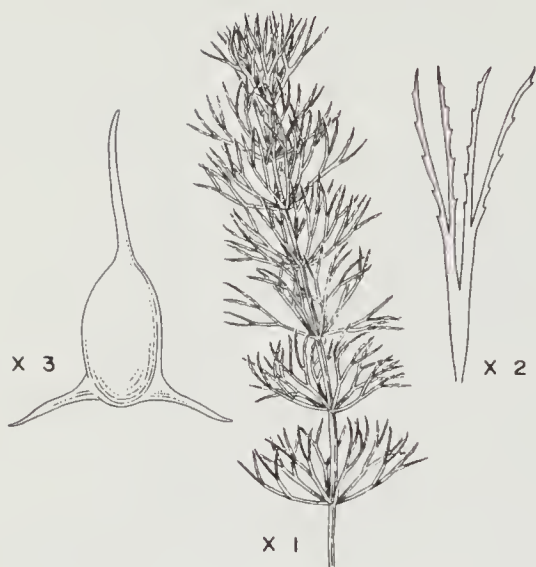
2. NUPHAR: *Spatter-dock, Cow-lily*

The representatives of *Nuphar* in the southeastern portion of North Carolina present a gradual transition in morphological form which is correlated with environmental conditions of the habitat. De Poe and Beal (1969) have shown this variability to be genetically based, and that environmental selection is important in the maintenance of the morphological cline. Beal & Southall (1977), using experimental techniques, have shown vernalization to be an effective natural selection mechanism.

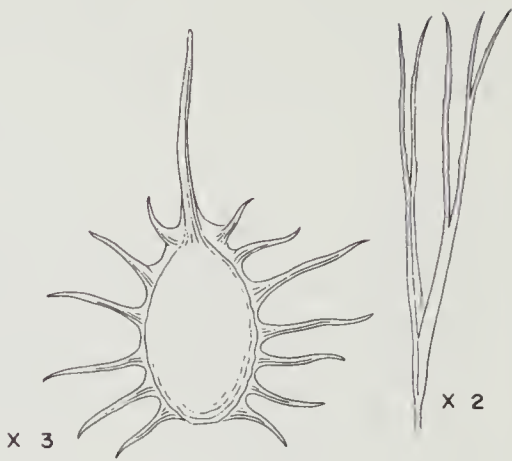
- a. Floating or emersed leaves with a length-width ratio of less than 3.....1.a. *N. luteum* subsp. *macrophyllum*

CERATOPHYLLUM

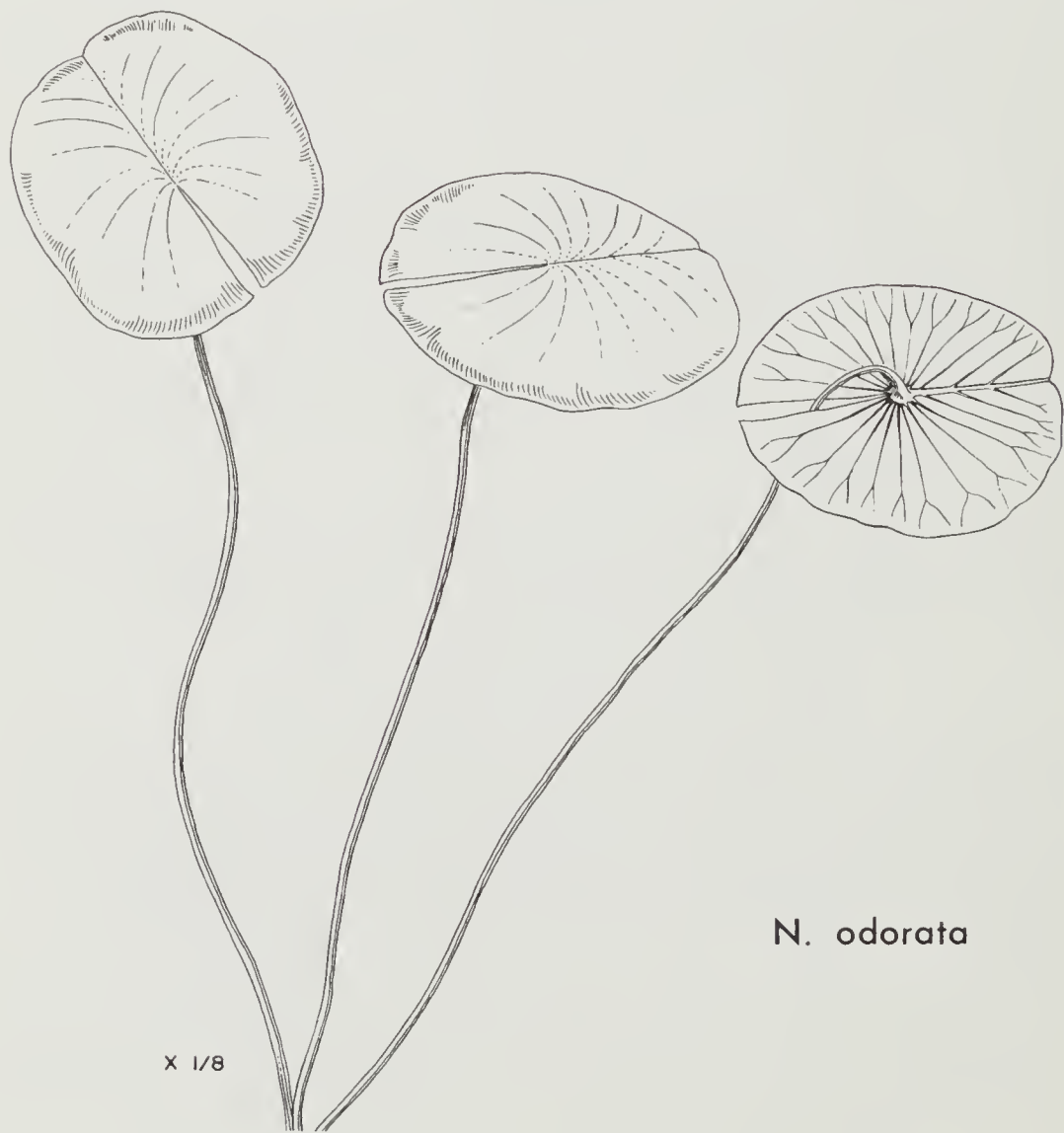
NYMPHAEA



*C. demersum*



*C. echinatum*



*N. odorata*



- a. Floating or submersed leaves with a length-width ratio of more than 3.....1.b. *N. luteum* subsp. *sagittifolium*

- 1. *Nuphar luteum* (L.) Sibth. & Smith
  - a. subsp. *macrophyllum* (Small) E. O. Beal

Abundant in ditches, ponds, lakes, and streams throughout the Coastal Plain of North Carolina and less frequent in the Piedmont and Blue Ridge provinces. Extending northward into Maine, southward into Florida and westward into Wisconsin, Missouri, Kansas, Oklahoma, and Texas. [*Nymphaea advena* Ait., *Nymphaea macrophylla* Small, *Nuphar advena* (Ait.) Ait. f.]

- b. subsp. *sagittifolium* (Walt.) E. O. Beal

Locally abundant in lakes and streams in the southern half of the Coastal Plain of North Carolina. Extending northward into Virginia and southward into South Carolina. [*Nymphaea sagittifolia* Walt., *Nuphar sagittifolium* (Walt.) Pursh]

- c. Intermediates of the above subspecies with leaf length-width ratios  $\pm$  3. Locally abundant chiefly in the southern half of the Coastal Plain of North Carolina.

--NELUMBONACEAE--

1. NELUMBO: *Sacred Bean*

- a. Petals yellow.....1. *N. pentapetala*
- a. Petals pink.....2. *N. nucifera*

- 1. *Nelumbo pentapetala* (Walt.) Fern., *Wonkapin*

Locally abundant in ponds and sluggish streams chiefly in the Coastal Plain of North Carolina. Extending northward into New York, southward into Florida and westward into Minnesota, Iowa, Nebraska, Kansas, Oklahoma, and Texas. [*N. lutea* (Willd.) Pers.]

- 2. *Nelumbo nucifera* Gaert., *Sacred Lotus* (Not illustrated)

An introduction from Asia which has become established in ponds in Anson, Halifax, New Hanover, and Wake counties of North Carolina.

--CABOMBACEAE--

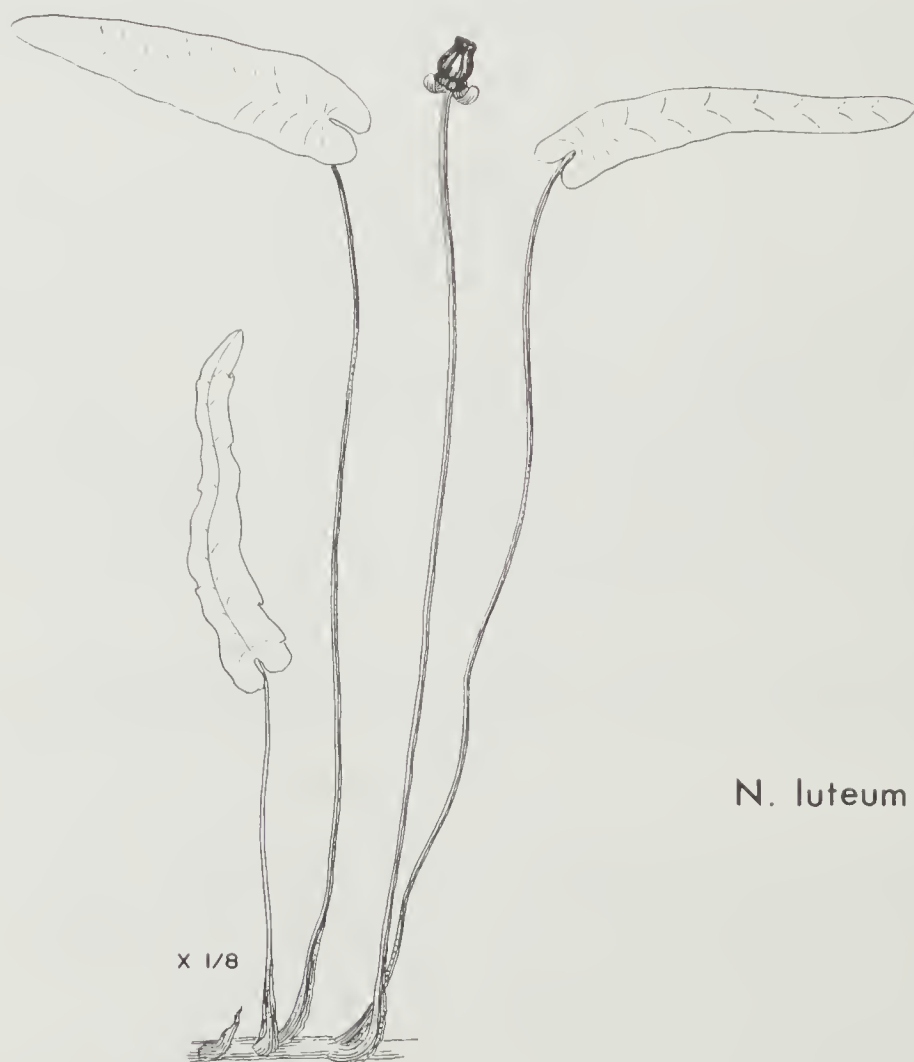
- a. Plants heavily coated with mucilage, with only broadly peltate, floating, alternate leaves; flower dull purple; stamens 18-36.....1. *Brasenia*
- a. Plants not coated with mucilage, with both submersed and, when flowering, floating leaves; submersed leaves dichotomously dissected into linear or filiform segments, opposite; floating leaves narrowly elliptic and peltate.....2. *Cabomba*

# NUPHAR



subsp. macrophyllum

subsp. sagittifolium



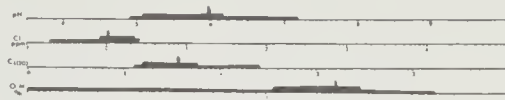
N. luteum

subsp. sagittifolium

## 1. BRASENIA: *Water Shield*

### 1. *Brasenia schreberi* Gmel.

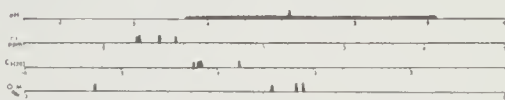
Locally abundant in ponds and sluggish streams chiefly in the Coastal Plain of North Carolina. Extending northward into Maine, southward into Florida and westward into Minnesota, Iowa, Nebraska, Kansas, Oklahoma, and Texas; northwestern states.



## 2. CABOMBA: *Fanwort*

### 1. *Cabomba caroliniana* Gray

Locally abundant in ponds and sluggish streams chiefly in the Coastal Plain of North Carolina. Extending northward into New England, southward into Florida and westward into Michigan, Illinois, Missouri, Arkansas, and Texas.



## --RANUNCULACEAE--

- a. Leaves primarily basal, long-petioled, ovate to reniform, 5-15 cm wide and long, crenate to dentate, unlobed; sepals petal-like; petals absent; fruit a follicle with red, lustrous seeds.....1. *Caltha*
- a. Leaves basal or cauline, smaller than above or, if as large, deeply lobed; sepals inconspicuous; petals present; fruit an achene.....2. *Ranunculus*

## 1. CALTHA: *Marsh-marigold*

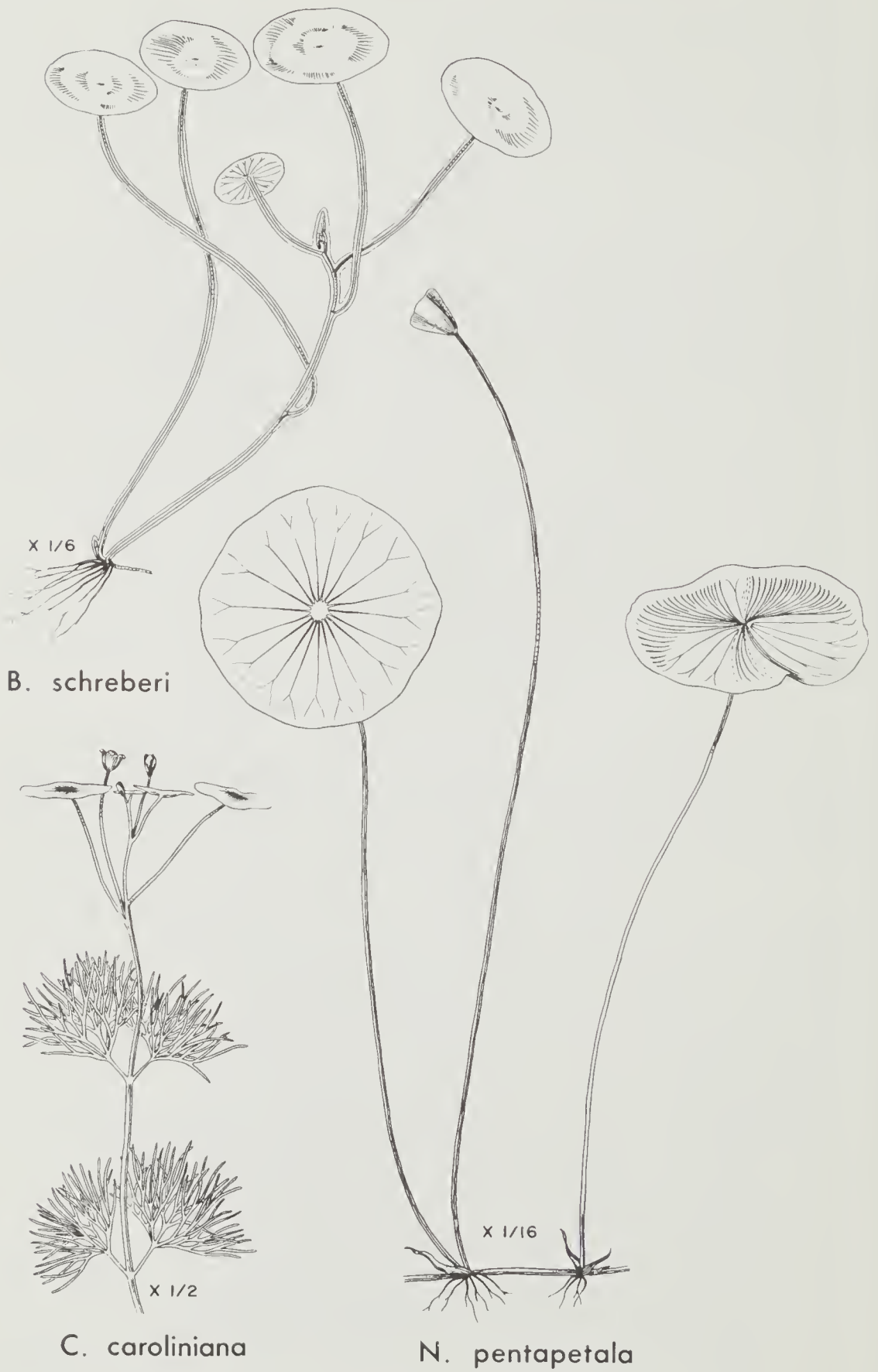
### 1. *Caltha palustris* L.

Rare in marshes in the Blue Ridge Province of North Carolina. Extending northward into Maine and westward into Minnesota, Iowa, Illinois, Indiana, and, in the mountains, Tennessee.

## 2. RANUNCULUS: *Buttercup*

- a. Petals white to yellowish-green; nutlet transversely ridged.....1. *R. hederaceus*
- a. Petals yellow; nutlet smooth, pitted or pebbled.
  - b. Nutlet flat, distinctly corky-thickened on the ventral margin.....2. *R. carolinianus*
  - b. Nutlet turgid, with or without a distinct, corky, marginal band.
    - c. Leaves toward base lobed to deeply divided.
      - d. Submersed leaves present, with ternately compound, flaccid, linear-filiform segments (plants stranded on shore may have leaf segments much less divided); petals 6-14 mm long; nutlet with a corky marginal band along base and ventral margin; beak of nutlet more than 2 mm long.....3. *R. flabellaris*
      - d. Submersed leaves not produced (if in deep water the petioles elongating and blades floating); petals 2-5 mm long; nutlet without a corky margin; beak of nutlet minute.....4. *R. sceleratus*

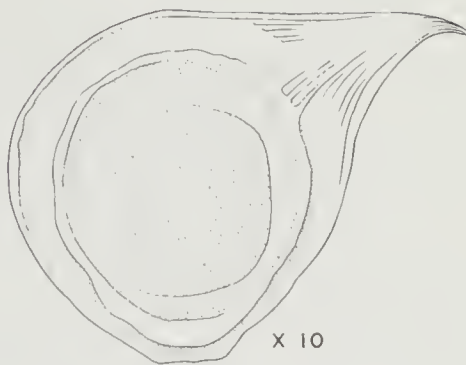
NELUMBO    BRASENIA    CABOMBA



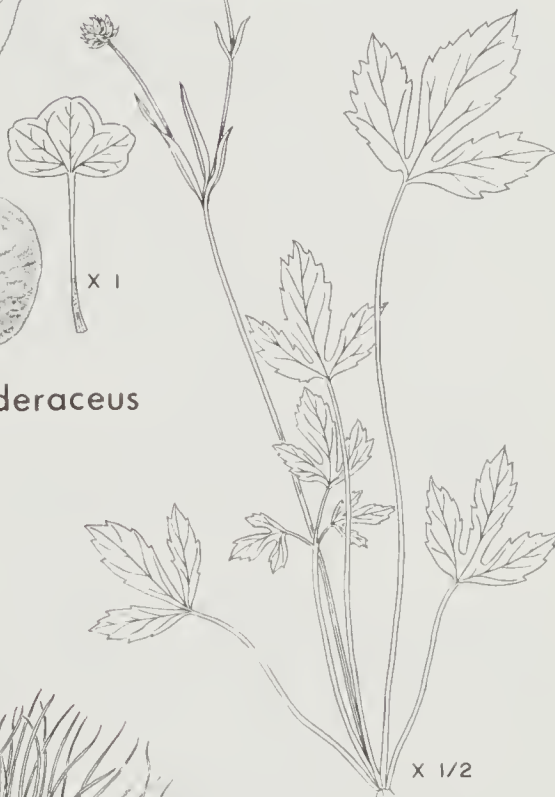
CALTHA RANUNCULUS



*C. palustris*



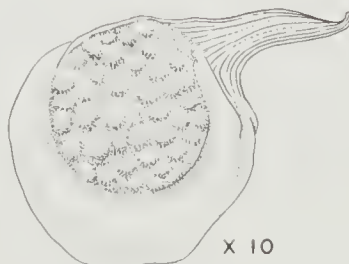
*R. hederaceus*



*R. flabellaris*



*R. carolinianus*





- c. Leaves all entire, dentate, serrulate, crenate or undulate but not cleft.
- e. Nutlet 2-2.5 mm long, beaked.....5. *R. ambigens*
- e. Nutlet less than 1.5 mm long, more-or-less beakless.
- f. Petals 1-4 (rarely 5) in number, less than 2.7 mm long, slightly longer than the sepals; leaves ovate below to linear above.....6. *R. pusillus*
- f. Petals 4-8 in number, more than 2.7 mm long, about twice the length of the sepals; leaves subcordate below to linear above.....7. *R. subcordatus*

1. *Ranunculus hederaceus* L.

Rare in marshes in Currituck County of North Carolina. Extending, along the Atlantic coast, northward into Pennsylvania and southward into South Carolina.

2. *Ranunculus carolinianus* DC.

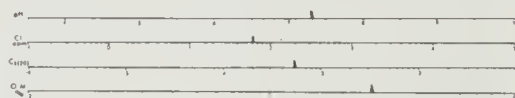
Infrequent in low woods and marshes in scattered localities throughout the Piedmont and Coastal Plain provinces of North Carolina. Extending northward into Maryland, southward into Florida and westward into southern Illinois, Missouri, Nebraska, and Texas.

3. *Ranunculus flabellaris* Raf., *Water Crowfoot*

Very rare in a cypress pool in Edgecombe County, North Carolina. Extending northward into Maine, southward into Alabama and westward into Minnesota, Iowa, Missouri, Louisiana, and Oklahoma; northwestern states. [*R. delphinifolius* Torr.]

4. *Ranunculus sceleratus* L.

Locally abundant in ditches, stream margins, and marshes chiefly in the outer Coastal Plain of North Carolina. Extending throughout most of the United States.

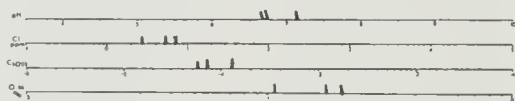


5. *Ranunculus ambigens* Wats.

Rare in marshes in Bertie, Orange, and Perquimans counties of North Carolina. Extending northward into Maine, southward into Georgia and westward into Minnesota, Indiana, Kentucky, Tennessee, and Louisiana. [*R. obtusiusculus* Raf., *R. mississippiensis* Small]

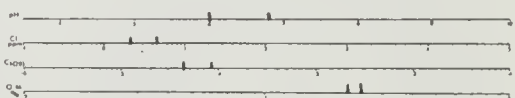
6. *Ranunculus pusillus* Poir.

Common in low ground, ditches, and marshes chiefly in the Piedmont and Coastal Plain provinces of North Carolina. Extending northward into New York, southward into Florida and westward into Ohio, Indiana, Missouri, Oklahoma, and Texas; California.



7. *Ranunculus subcordatus* E. O. Beal

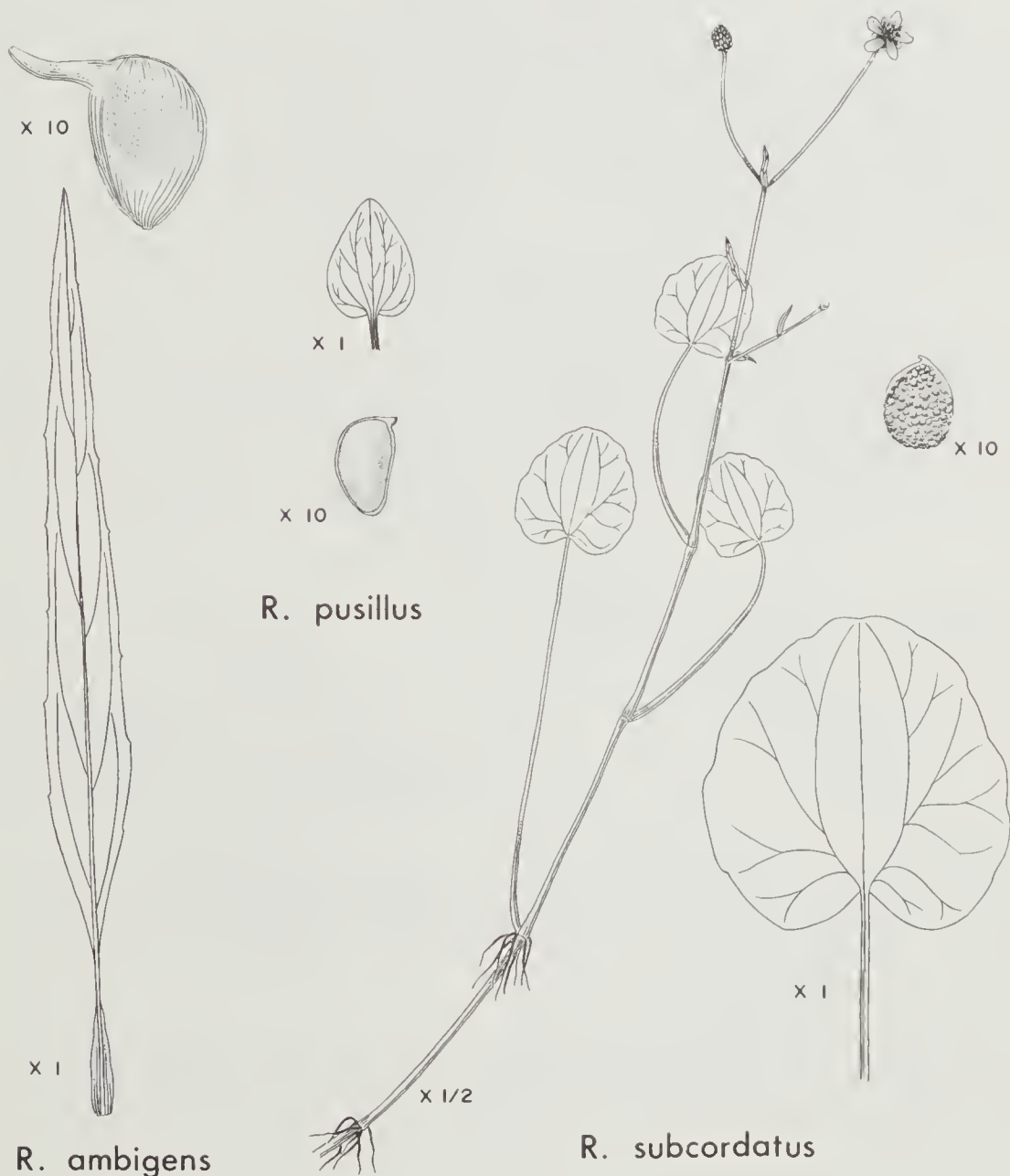
Known only from stream banks in Bladen and Halifax counties of North Carolina.



# RANUNCULUS



*R. sceleratus*



*R. pusillus*

*R. ambigens*

*R. subcordatus*

- a. Leaves toward base of stem repeatedly divided into numerous filiform segments; emerged leaves, if present, less dissected to not dissected; fruit slightly longer than broad.....1. *Armoracia*
- a. Leaves not divided into filiform segments, simple, or, if divided, the divisions broad; fruit much longer than broad.
  - b. Leaves pinnately compound or pinnately divided nearly to the rachis, lobes numerous; fruit round in cross-section.....2. *Nasturtium*
  - b. Leaves simple or, at most, pinnately divided with no more than 2 pairs of lateral divisions; fruit flattened in cross-section.....3. *Cardamine*

# 1. ARMORACIA

## 1. *Armoracia aquatica* (Eat.) Wieg. Lake Cress

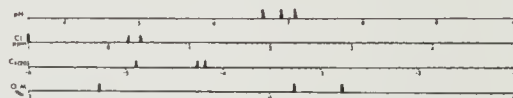
Reported to occur in North Carolina but no specimens have been seen. It should occur in quiet water of lakes and streams and on muddy banks. Extending northward into New England, southward into Florida and westward into Minnesota, Illinois, Arkansas, and Texas. [*Neobeckia aquatica* (Eat.) Britt., *Rorippa aquatica* (Eat.) Palmer & Steyermark, *R. americana* (Gray) Britt., *Radicula aquatica* Robins., *Nasturtium lacustre* Gray]

# 2. NASTURTIUM: Watercress

## 1. *Nasturtium officinale* R. Brown

Locally abundant in shallow streams in scattered localities throughout North Carolina. Extending throughout the United States. [*Sisymbrium*

*nasturtium-aquaticum* L., *Rorippa nasturtium-aquaticum* (L.) Hayek]



# 3. CARDAMINE: Bitter Cress

- a. Stem leaves pinnately dissected with no more than 2 pairs of lateral divisions.....1. *C. clematitis*
- a. Stem leaves simple.
  - b. Flowers pink-purple; stem erect from a tuberous base.....2. *C. douglassii*
  - b. Flowers white; stem weak; trailing and often rooting at the nodes.....3. *C. rotundifolia*

## 1. *Cardamine clematitis* Shuttlew.

Common in wet places and in streams in the Blue Ridge Province of North Carolina. Extending northward, in the mountains, northward into Virginia, southward into Georgia and westward into Tennessee and Alabama. [*C. flagellaris* O. E. Schulz, *C. hugeri* Small]

## 2. *Cardamine douglassii* (Torr.) Britt.

Infrequent in low woods and marshes chiefly in the Piedmont of North Carolina. Extending northward into Connecticut, southward into South Carolina and westward into Wisconsin and Missouri.

ARMORACIA    NASTURTIIUM



A. aquatica

N. officinale

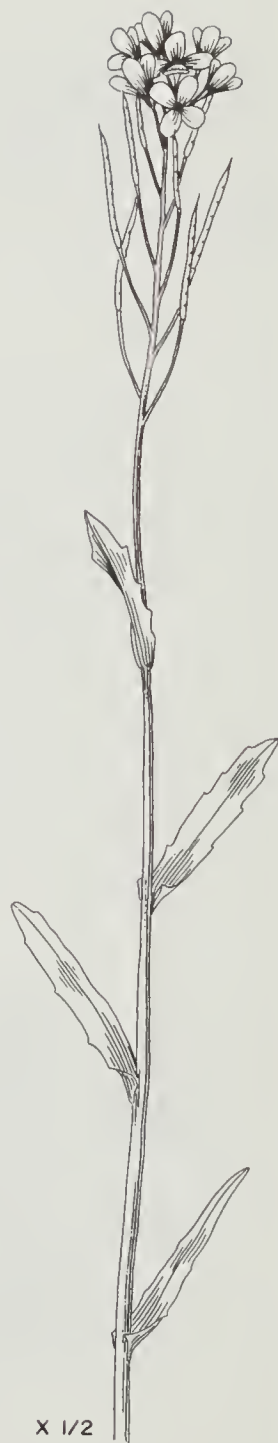
# CARDAMINE



*C. rotundifolia*



*C. clematitis*



*C. douglassii*



3. *Cardamine rotundifolia* Michx.

Rare in low woods and streams in Ashe and Watauga counties of North Carolina. Extending northward into New York and westward into Ohio and Kentucky.

--SARRACENIACEAE--

1. SARRACENIA: *Pitcher Plant, Trumpets*

- a. Leaves (pitchers) decumbent; relatively short.....1. *S. purpurea*  
a. Leaves erect, elongate.  
b. Orifice of pitcher closely covered by an arched hood  
with translucent scar-like blotches.....2. *S. minor*  
b. Orifice of pitcher exposed; hood without translucent  
blotches.  
c. Hood 4-10 cm wide, the margins reflexed; petals over  
4 cm long, usually yellow.....3. *S. flava*  
c. Hood 1-3 cm wide, the margins not reflexed; petals  
less than 4 cm long, usually maroon.....4. *S. rubra*

1. *Sarracenia purpurea* L., *Flytrap*

Locally abundant in bogs and low savannahs in the Coastal Plain and very rare in isolated bogs in the Piedmont and Blue Ridge provinces of North Carolina. Extending northward into Maine, southward into Florida and westward into Minnesota, Tennessee, and Louisiana.

2. *Sarracenia minor* Walt., *Hooded Pitcher Plant*

Locally abundant in ditches, bogs, and low savannahs in the southern portion of the Coastal Plain of North Carolina. Extending southward into Florida.

3. *Sarracenia flava* L., *Trumpets*

Locally very abundant in bogs and savannahs chiefly in the Coastal Plain of North Carolina. Extending northward into Virginia and southward into Florida and Alabama.

4. *Sarracenia rubra* Walt., *Sweet Pitcher Plant*

Locally abundant in bogs and savannahs in the Coastal Plain and less abundant along streams in the Blue Ridge of North Carolina. Extending southward into Florida and westward into Mississippi. [*S. jonesii* Wherry]

--PODOSTEMACEAE--

1. PODOSTEMUM: *Riverweed*

1. *Podostemum ceratophyllum* Michx.

Locally very abundant as a mat attached to rocks in clear-water streams chiefly in the Blue Ridge and Piedmont provinces of North Carolina.

Extending northward into Maine, southward, in the higher elevations, into Georgia and westward into New York, Pennsylvania, West Virginia, Kentucky, Tennessee, Arkansas, Louisiana, and Texas; reported in Minnesota.

This species is highly variable in form, tending to be very short and mat-like in sunny areas but greatly elongated in shaded areas.



# SARRACENIA



*S. purpurea*



*S. minor*



*S. flava*

--CRASSULACEAE--

1. PENTHORUM: *Ditch Stonecrop*

1. *Penthorum sedoides* L.

Abundant in ditches, marshes, low ground, and along stream and pond margins throughout North Carolina but less frequent in the Blue Ridge

Province. Extending northward into Maine, southward into Florida and westward into Minnesota, Nebraska, and Texas.



--DROSERACEAE--

1. DROSERA: *Sundew*

- a. Leaves arising basally; blades orbicular to reniform, wider than long; petioles 2-6 cm long.....1. *D. rotundifolia*
- a. Leaves arising basally and often from an elongated stem; blades spatulate.....2. *D. intermedia*

1. *Drosera rotundifolia* L.

Rare in acidic bogs and lake margins in the Blue Ridge Province and the Sand Hills of North Carolina. Extending northward into Maine, southward into Florida and westward into California, Illinois, Tennessee, and Alabama.

2. *Drosera intermedia* Hayne

Frequent in acidic pools, ditches, and low ground chiefly in the Coastal Plain of North Carolina. Extending northward into Maine, southward, in the Atlantic and Gulf coastal states, into Texas and westward into Minnesota, Illinois, and Tennessee.



--ROSACEAE--

1. ROSA: *Rose*

1. *Rosa palustris* Marsh., *Swamp Rose*

Abundant in ponds, marshes, and along streams throughout North Carolina. Extending northward into Maine, southward into Florida and westward into Minnesota, Arkansas, and Texas. [*R. floridana* Rydb., *R. virginiana* Miller]



--FABACEAE (LEGUMINOSAE)--

1. AESCHYNOMENE: *Sensitive-joint-vetch*

- a. Fruiting stipe 1.2 cm long or longer; bractlets subtending the calyx with toothed margins; fruiting stipe 1.2 cm long or more; leaflets mostly 1 cm or more in length..1. *A. virginica*



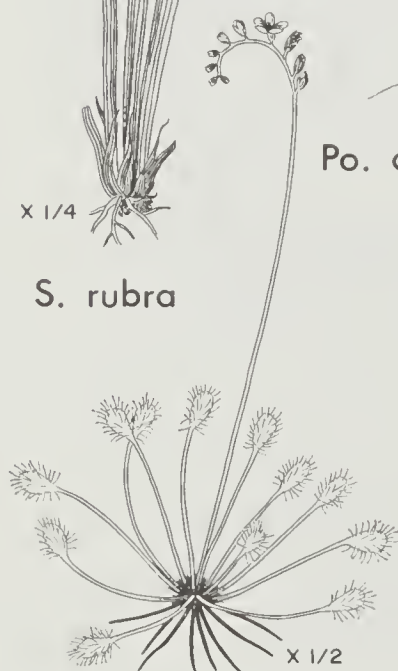
*S. rubra*



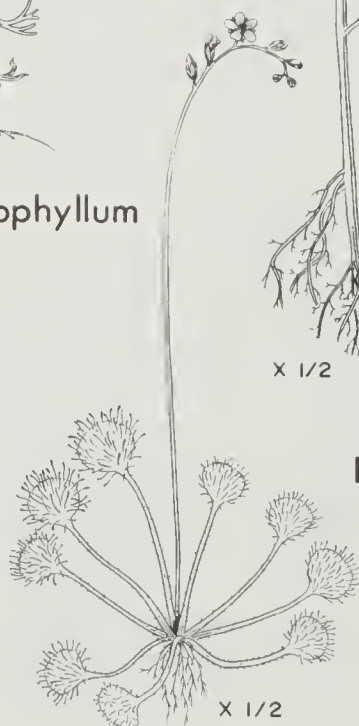
*Po. ceratophyllum*



*Pe. sedoides*



*D. intermedia*

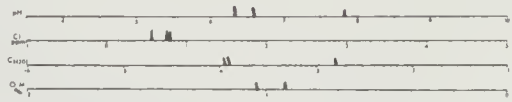


*D. rotundifolia*

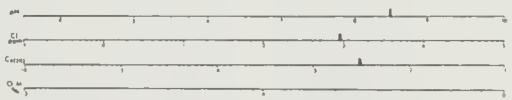


- a. Fruiting stipe at most 1 cm long; bractlets subtending the calyx entire or essentially so; fruiting stipe less than 1 cm long; leaflets mostly less than 1 cm long.....2. *A. indica*

1. *Aeschynomene virginica* (L.) BSP.  
 Infrequent on wet shores of rivers, lakes, and tidal marshes in the central and southern portions of the outer Coastal Plain. Extending northward into New Jersey and southward into South Carolina.



2. *Aeschynomene indica* L.  
 Infrequent on wet shores of rivers, lakes, and ditches in the central and southern portions of the outer Coastal Plain of North Carolina. Extending, along the Atlantic and Gulf coasts, into Florida and Texas.



--POLYGALACEAE--

1. POLYGALA: *Polygala*

1. *Polygala cymosa* Walt.  
 Frequent in shallow acidic water of sandy ponds, ditches, and bogs chiefly in the southeastern portion of the Coastal Plain of North Carolina. Extending, along the Coastal Plain, northward into Delaware and southward into Florida and Louisiana. [*Pilostaxis cymosa* (Walt.) Small]  
 Several other species of *Polygala* are to be found in moist areas of savannahs, pine barrens, bogs, and low pocosins. Thus, if the above species is not clearly indicated, a more comprehensive mannual should be consulted.

--CALLITRICHACEAE--

1. CALLITRICHE: *Water Starwort*

1. *Callitriche heterophylla* Pursh  
 Frequent in ponds, lakes, and streams in the Blue Ridge, outer Piedmont, and Coastal Plain provinces of North Carolina. Extending throughout the United States.



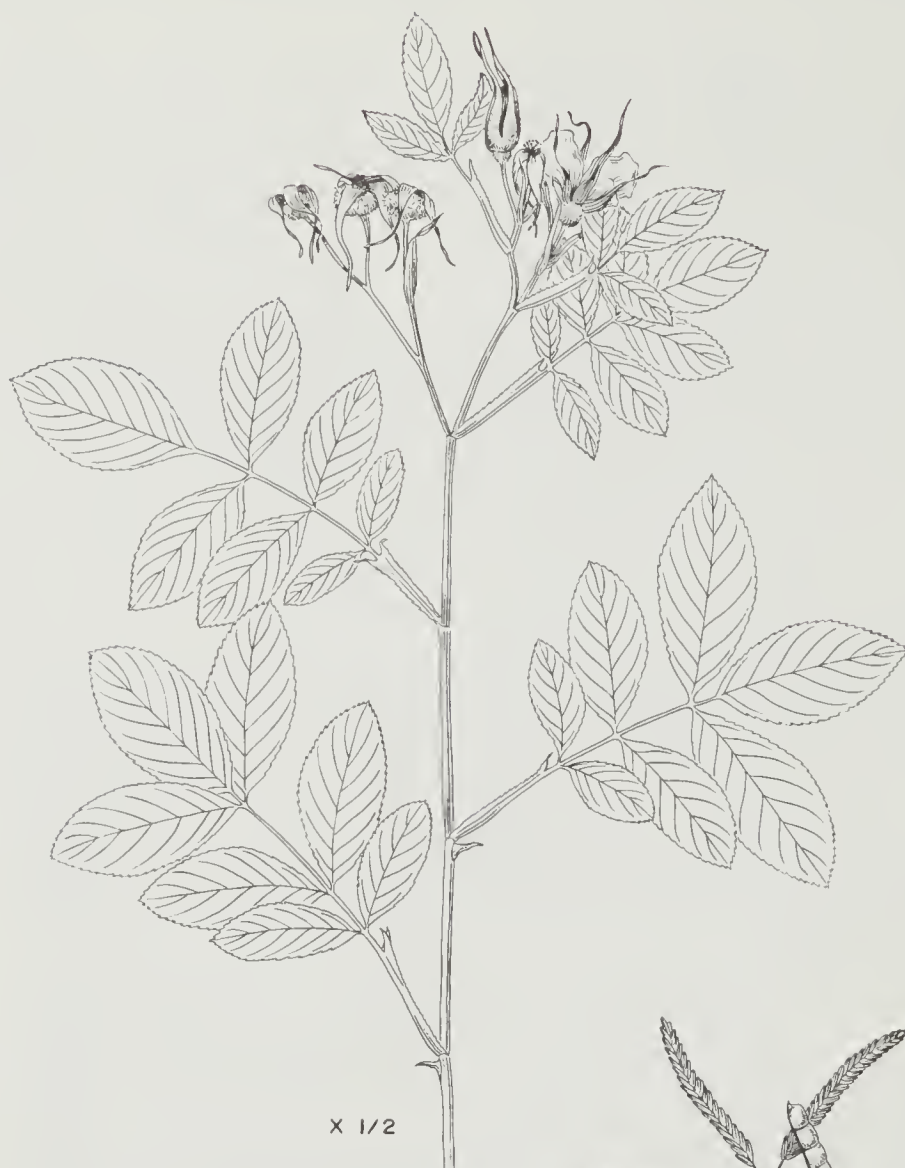
--BALSAMINACEAE--

1. IMPATIENS: *Jewelweed, Touch-me-not*

- a. Calyx spur curved forward close to the sepal, about 8 mm long; flowers commonly orange-yellow and spotted with brown.....1. *I. capensis*
- a. Calyx spur at right-angle to the sepal, about 5 mm long; flowers commonly pale yellow with brown spots.....2. *I. pallida*



ROSA AESCHYNOMENE



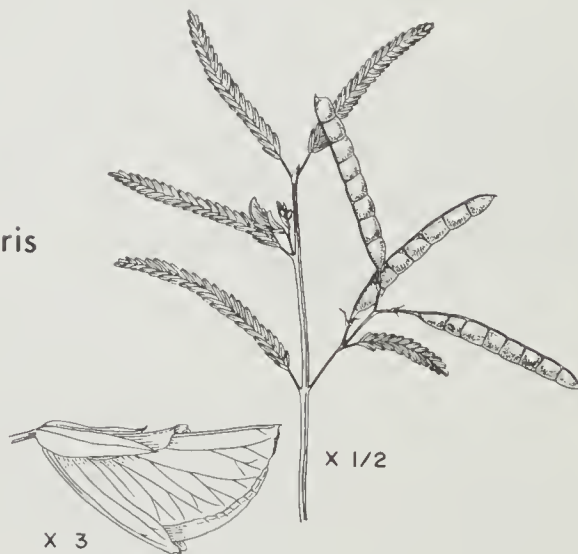
X 1/2

*R. palustris*



X 3

*A. virginica*



X 1/2

X 3

*A. indica*

POLYGALA

CALLITRICHE

IMPATIENS



*P. cymosa*



*C. heterophylla*



*I. capensis*



*I. pallida*

1. *Impatiens capensis* Meerb., Spotted Touch-me-not

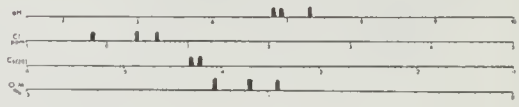
Common in moist soil, marshes, and stream margins throughout North Carolina. Extending northward into Maine, southward into Georgia and westward into Montana, Arkansas, Oklahoma, and Texas.



[*I. biflora* Walt.]

2. *Impatiens pallida* Nutt.

Locally abundant in wet, springy areas of the Blue Ridge and Piedmont provinces of North Carolina. Extending northward into Maine, southward into Georgia and westward into Montana, Kansas, Missouri, and Oklahoma.



--MALVACEAE--

- a. Stem, peduncles, and leaves harshly pubescent; petals no more than 3.5 cm long; locules of fruit 1-seeded...1. *Kosteletzkya*
- a. Stem, peduncles, and leaves glabrous or soft-pubescent; petals 6-10 cm long; locules of fruit few-to-many seeded...2. *Hibiscus*

1. KOSTELETSKYA: Seashore-mallow

1. *Kosteletzkya virginica* (L.) Presl

Common, usually in brackish marshes, in the outer Coastal Plain of North Carolina. Extending, along the Atlantic and Gulf coasts, southward into Florida and Texas. [*K. althaeifolia* (Chap.) Gray]



2. HIBISCUS

- a. Stem and leaves glabrous; median and upper leaves usually hastate.....1. *H. militaris*
- a. Stem and leaf surfaces pubescent; median and upper leaves with rounded bases.....2. *H. moscheutos*

1. *Hibiscus militaris* Cav., Halberd-leaved Marsh Mallow

Locally abundant in shallow water and low ground along streams chiefly in the Coastal Plain of North Carolina. Extending northward into Pennsylvania, southward into Florida and westward into West Virginia, Ohio, Indiana, Illinois, Minnesota, Nebraska, and Texas.

2. *Hibiscus moscheutos* L., Rose Mallow, Wild Cotton

Throughout North Carolina but more abundant in the Piedmont and Coastal Plain provinces. Extending northward into Maryland, southward into Florida and westward into West Virginia, Ohio, Indiana, Kentucky, Tennessee, and Alabama; Oklahoma and Texas. [Includes *H. oculiroseus* Britt., *H. palustris* L.]



KOSTELETZKYA

HIBISCUS



*K. virginica*



*H. militaris*



*H. moscheutos*

--HYPERICACEAE--

1. HYPERICUM: *St. John's-wort*

- a. Leaves less than 2 cm long, linear; plant woody.
  - b. Bark on lower part of stem thick and spongy.....1. *H. fasciculatum*
  - b. Bark on lower part of stem thin, not spongy.....2. *H. nitidum*
- a. Leaves mostly more than 2 cm long, elliptic, ovate or oblong; plant herbaceous.
  - c. Blade of leaf borne on petiole 3-15 mm long.....3. *H. walteri*
  - c. Blade of leaf sessile.
    - d. Leaves pinnately veined.....4. *H. virginicum*
    - d. Leaves with 3-5 palmately arranged veins.....5. *H. mutilum*

Numerous other species of *Hypericum* are to be expected in low ground, ditches, and pond margins. Thus, if one of the above is not clearly indicated, a more comprehensive manual should be consulted.

1. *Hypericum fasciculatum* Lam.

Locally abundant in low pocosins and margins of ponds in the southeastern Coastal Plain of North Carolina. Extending, along the Atlantic and Gulf coasts, into Florida and Texas. [*H. aspalathoides* Willd.]

2. *Hypericum nitidum* Lam.

Rare in low pocosins and shallow pools of Brunswick County, North Carolina. Extending southward into Florida and Alabama.

3. *Hypericum walteri* Gmel.

Locally abundant in low pocosins, swamps, and marshes chiefly in the Piedmont and Coastal Plain provinces of North Carolina. Extending northward into Maryland, southward into Florida and westward into West Virginia, Indiana, Missouri, and Texas. [*Triadenum tubulosum* var. *walteri* (Gmel.) Lott, *T. petiolatum* (Walt.) Britton, *T. walteri* (Gmel.) Gleason]

4. *Hypericum virginicum* L.

Common in low ground, marshes, and bogs chiefly in the Coastal Plain of North Carolina. Extending northward into New England, southward into Florida and westward into Illinois, Tennessee, Louisiana, and Texas. [*Triadenum virginicum* (L.) Raf.]

5. *Hypericum mutilum* L.

Common in low ground, ditches, bogs, and marshes throughout North Carolina. Extending throughout the eastern half of the United States.

--ELATINACEAE--

1. ELATINE: *Waterwort*

1. *Elatine triandra* Schkuhr

Rare in ponds of Jackson County, North Carolina. Extending, in widely scattered localities, northward into Maine, southward into Georgia and





HYPERICUM      ELATINE



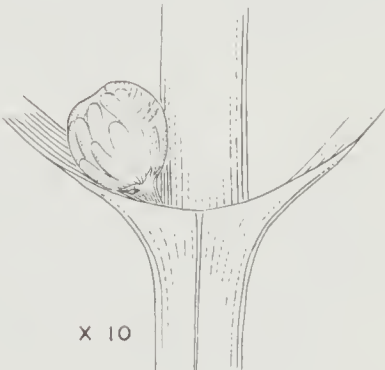
*H. fasciculatum*



*H. walteri*



*H. nitidum*



x 10



*H. mutilum*



*H. virginicum*



*E. triandra*

westward into Oregon, California, Arizona, Texas, Oklahoma, Missouri, and Tennessee. [*E. americana* (Pursh) Arnott]

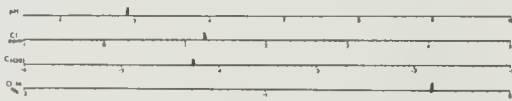
--VIOLACEAE--

1. VIOLA: *Violet*

- a. Leaf base cordate; leaves less than 1.5-times as long as wide.....1. *V. macloskeyi*
- a. Leaf base tapering, truncate, rounded or slightly cordate; leaves more than 1.5-times as long as wide.....2. *V. primulifolia*

1. *Viola macloskeyi* var. *pallens* (Banks ex DC.) C. L. Hitch.  
Infrequent in bogs and springy soil along stream margins in the Blue Ridge Province of North Carolina. Extending northward into Maine, southward, in the mountains, into Georgia and Alabama and westward into Montana, Colorado, Illinois, Indiana, Ohio, and eastern Tennessee.  
[*V. pallens* (Banks) Brain.]

2. *Viola primulifolia* L.  
Common in wet soil and very shallow water along pond and stream margins throughout North Carolina. Extending throughout the eastern half of the United States.



--LYTHRACEAE--

- a. Stem lax, plant usually submersed; calyx without appendages; petals 0.....1. *Peplis*
- a. Stem stiff, plant emergent; calyx with appendages; petals 0-7.
  - b. Plant a woody shrub; leaves opposite or whorled.....2. *Decodon*
  - b. Plant herbaceous; leaves opposite.
    - c. Calyx tubular, cylindric, symmetrical or asymmetrical.
      - d. Stem covered with stiff hairs; calyx asymmetrical, obliquely swollen on one side.....3. *Cuphea*
      - d. Stem glabrous; calyx symmetrical.....4. *Lythrum*
    - c. Calyx short, campanulate to globular.
      - e. Flowers often several to an axil; capsule dehiscent irregularly; leaves sessile, with broadened or clasping bases.....5. *Ammannia*
      - e. Flowers usually one per axil; capsule septicidal; leaves petiolate (or if sessile, with narrow bases, never clasping).....6. *Rotala*

1. PEPLIS: *Water-purslane*

1. *Peplis diandra* Nutt. ex DC.  
Infrequent in streams along the Fall Line (juncture of the Piedmont and Coastal Plain provinces) as well as in the Chowan and Neuse drainage systems of North Carolina. Extending northward into Virginia, southward into Florida and westward into Ohio, Indiana, Wisconsin, Minnesota, Nebraska, Kansas, Oklahoma, and Texas. [*Didiplis diandra* (Nutt.) Wood]



Leaf shape is very variable in this species with the submersed leaves more narrowly linear and the emersed leaves, usually on plants stranded on shore, broader and often cuneate-lanceolate.

This species, in the vegetative condition, can be confused easily with *Callitriche heterophylla*. The submersed leaf tips of *Callitriche*, however, are distinctly notched and bear two cusp-like projections. The submersed leaf tips of *Peplis* are rounded, square-cut or shallowly notched with, at most, minute lateral teeth.

2. DECODON: *Water-loosestrife, Water-willow*

1. *Decodon verticillatus* (L.) Ell.

Common in swamps and marshes in the Coastal Plain of North Carolina. Extending throughout the United States from Minnesota and Texas eastward.



3. CUPHEA: *Waxweed*

1. *Cuphea carthagensis* (Jacq.) Macb.

Common in low ground and very shallow water along streams, ponds, and ditches in the Coastal Plain of North Carolina. Extending southward, along the Atlantic and Gulf coasts, into Florida and Texas. [*Parsonsia balsamona* (C. & S.) Stand.]

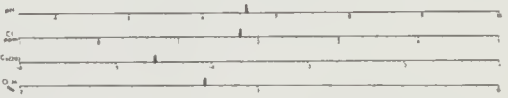


4. LYTHRUM: *Loosestrife*

- a. Leaf bases rounded or cordate; plant usually downy; flowers showy, cymose in axils of whorled or opposite upper leaves, forming interrupted spikes.....1. *L. salicaria*
- a. Leaf narrowed to base; plant essentially glabrous; flowers small, solitary in upper leaf axils.
  - b. Calyx lobes much shorter than the subulate appendages; ovary with a thick ring at its base; stem leaves mostly alternate.....2. *L. lanceolatum*
  - b. Calyx lobes and narrowly triangular appendages subequal; ovary without a basal ring; stem leaves opposite.....3. *L. lineare*

1. *Lythrum salicaria* L., *Purple Loosestrife*

Very rare in marshes of Watauga County, North Carolina. This is an aggressive introduction from Europe that has become established, often choking out native vegetation, in the northeastern United States. Extending northward into Maine and westward into Minnesota, Indiana, Ohio, and West Virginia; Missouri.



2. *Lythrum lanceolatum* Ell.

Infrequent in low ground, ditches, and marshes in the extreme southeastern Coastal Plain of North Carolina. Extending northward into New England, southward into Florida and westward into South Dakota, Arkansas, Oklahoma, and Texas; Colorado and Wyoming. [*L. alatum* var. *lanceolatum* (Ell.) T. & G.]

VIOLA

PEPLIS

DECODON



X 1/2

*V. macloskeyi*



X 1/2

*V. primulifolia*



X 2

SUBMERSED

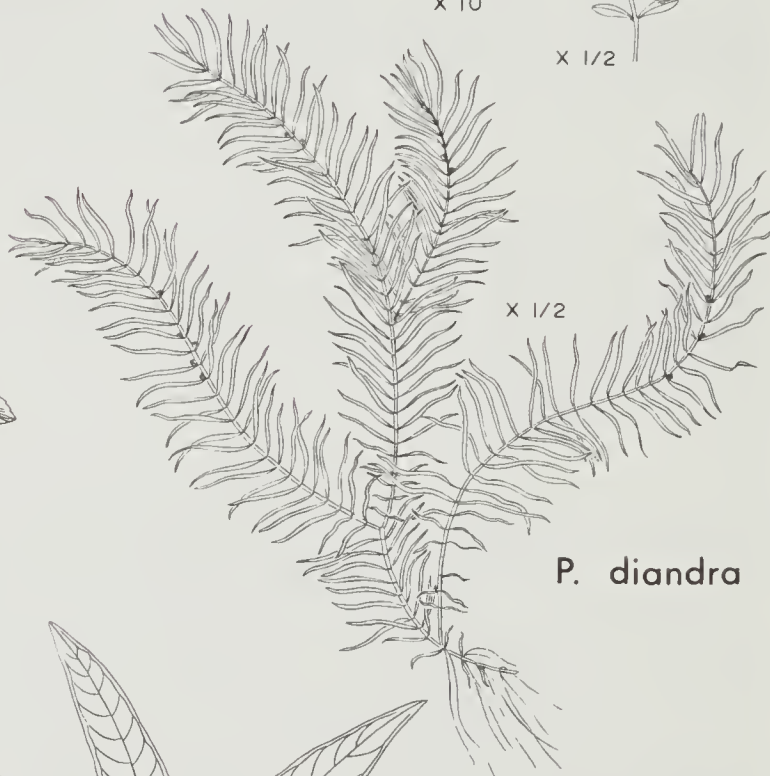
LEAF TIP →

X 10



X 1/2

*P. diandra*



X 1/2



X 1/2

*D. verticillatus*



CUPHEA LYTHRUM



*C. carthagensis*



*L. salicaria*



*L. lineare*

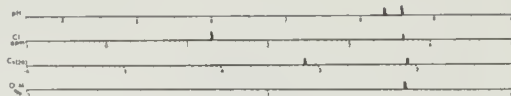


*L. lanceolatum*



### 3. *Lythrum lineare* L.

Frequent in brackish marshes in the outer Coastal Plain of North Carolina. Extending, in brackish and salt marshes, northward into Long Island and southward, along the Atlantic and Gulf coasts, into Florida and Texas.



## 5. AMMANNIA

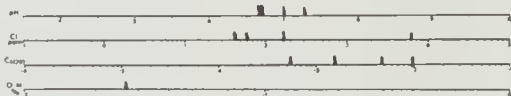
- a. Style slender, more than 1 mm long; leaves auriculate-clasping.....1. *A. coccinea*
- a. Style thick, less than 1 mm long; lower leaves tapering to base, upper leaves sometimes auriculate-clasping...2. *A. latifolia*

### 1. *Ammannia coccinea* Rottb.

Locally abundant in marshes of scattered locations throughout North Carolina. Extending southward into Florida and westward into Ohio, Illinois, Minnesota, Iowa, and Texas; Montana and Washington.

### 2. *Ammannia latifolia* L.

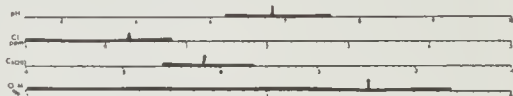
Locally abundant in brackish marshes and salt marshes in the outer Coastal Plain of North Carolina. Extending, in similar habitats, northward into New Jersey and southward, along the Atlantic and Gulf coasts, into Florida and Texas. [*A. teres* Raf., *A. koehnei* Britt.]



## 6. ROTALA

### 1. *Rotala ramosior* (L.) Koehne

Common in low ground, ditches, and marshes throughout North Carolina. Extending northward into New Hampshire, southward into Florida and westward into Minnesota, Iowa, Kansas, Oklahoma, and Texas; Washington and Oregon.



## --MELASTOMATACEAE--

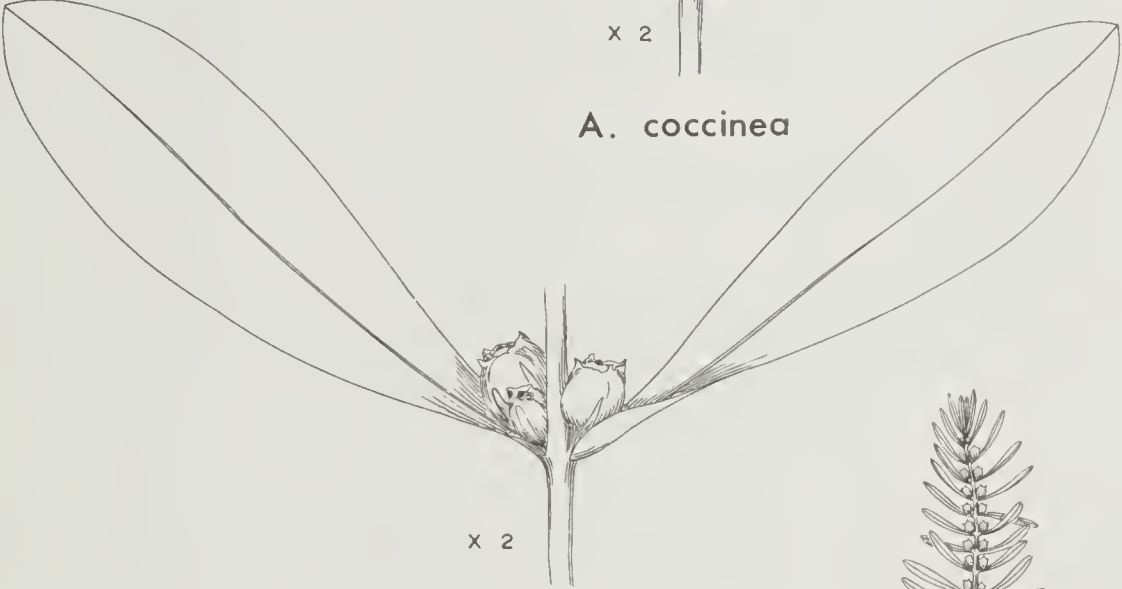
### RHEXIA: *Meadow-beauty*

- a. Stem and hypanthium glabrous.....1. *R. petiolata*
- a. Stem and hypanthium pubescent.
  - b. Leaves obtuse or rounded at the base, closely sessile; neck of the mature hypanthium only about one-half as long as the body; stem conspicuously winged; roots often tuberously thickened.....2. *R. virginica*
  - b. Leaves narrowed to an acute to cuneate base; neck of the mature hypanthium about as long as the body; stem not, or only slightly, winged; roots not tuberously thickened.
    - c. Blade of leaf lanceolate to elliptic, gradually tapering to a short petiole; stem faces unequal; stem not winged.....3. *R. mariana*
    - c. Blade of leaf oblong-ovate to elliptic-lanceolate, abruptly sessile to subsessile; stem faces essentially equal; stem narrowly winged.....4. *R. ventricosa*

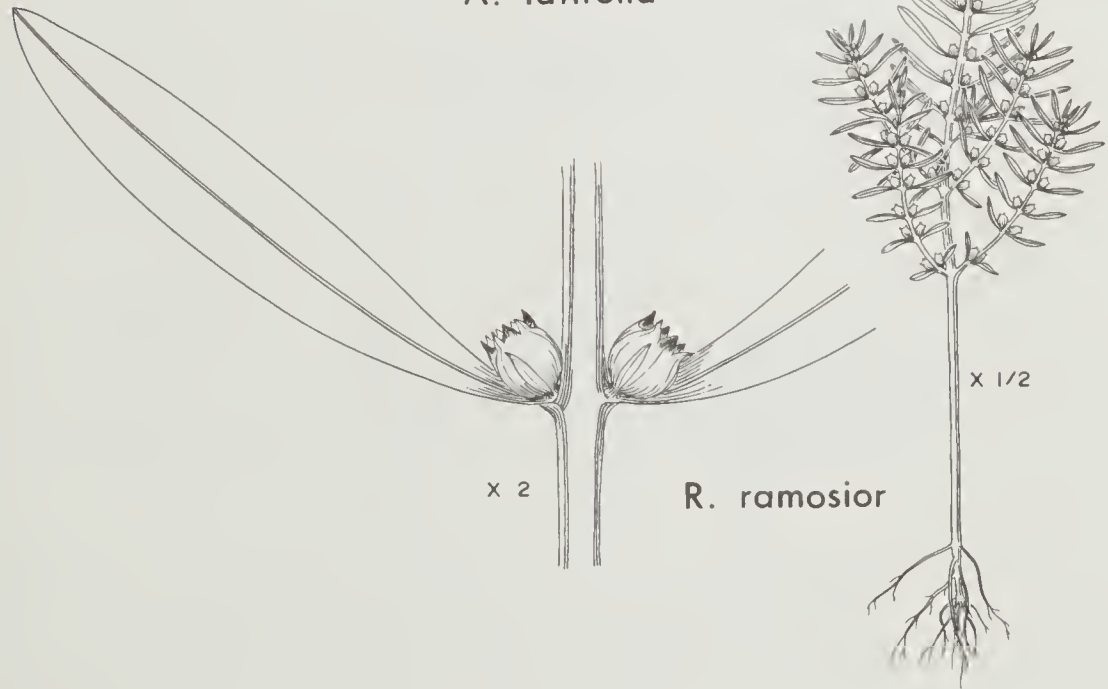
AMMANNIA      ROTALA



A. coccinea



A. latifolia

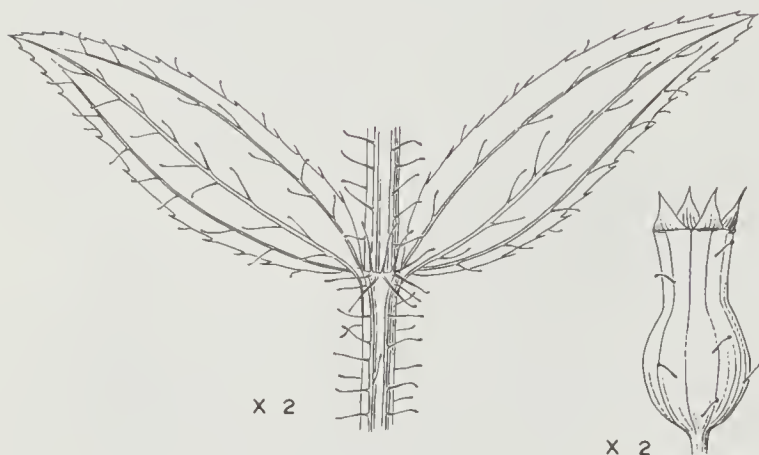


R. ramosior

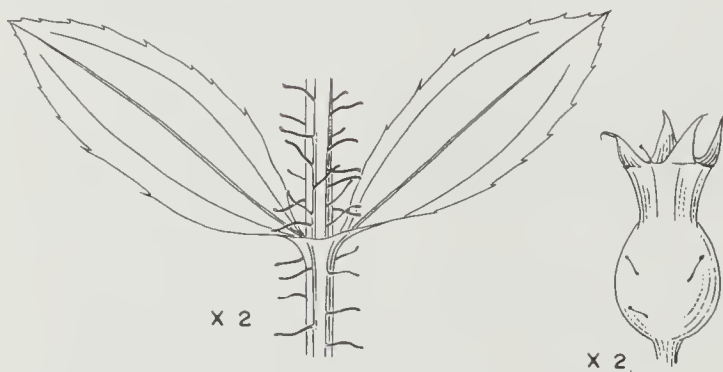
RHEXIA



*R. petiolata*



*R. mariana*



*R. ventricosa*



*R. virginica*

1. *Rhexia petiolata* Walt.

Frequent in bogs in the Coastal Plain of North Carolina. Extending, in similar habitats, northward into Virginia and southward, along the Atlantic and Gulf coasts, into Florida, and Texas. [*R. ciliosa* Michx.]

2. *Rhexia virginica* L.

Frequent in low ground, ditches, and bogs throughout North Carolina except for the central Piedmont and outer Coastal Plain. Extending northward into New England, southward into Florida and westward into Wisconsin, Missouri, Oklahoma, and Texas. [Includes *R. stricta* Pursh]

3. *Rhexia mariana* L.

Common in low ground, ditches, pond margins, and marshes throughout North Carolina. Extending, at lower elevations, northward into Massachusetts, southward into Florida and westward into southern Illinois, Missouri, and Texas. [Includes *R. delicatula* Small, *R. lanceolata* Walt., *R. nashii* Small]

4. *Rhexia ventricosa* Fern. & Grisc.

Rare in low ground and bogs in the Coastal Plain of North Carolina. Extending northward into Virginia and southward into South Carolina. This species, probably, should be considered a variety of *R. mariana*.

--ONAGRACEAE--

- a. Seeds with a tuft of hairs; petals pinkish.....1. *Epilobium*
- a. Seeds without a tuft of hairs; petals, if present, yellow.....2. *Ludwigia*

1. EPILOBIUM: Willow-herb

- a. Leaves usually conspicuously toothed, flat, more than 3 mm wide; stem angled to subterete, with lines, angles, or stripes of pubescence decurrent from the base of each leaf.....1. *E. coloratum*
- a. Leaves entire or nearly so, revolute, less than 3 mm wide; stem terete, without decurrent lines from the base of each leaf.....2. *E. leptophyllum*

1. *Epilobium coloratum* Biehler

Common in wet soil and marshes in the Blue Ridge and Piedmont provinces of North Carolina. Extending northward into Maine, southward into Georgia and westward into Minnesota, Kansas, Oklahoma, Texas, Arkansas, Tennessee, and Alabama.

2. *Epilobium leptophyllum* Raf.

Very rare in low ground, bogs, and marshes in Avery, Macon, and Watauga counties of North Carolina. Extending northward into New England and westward into Montana, Colorado, Utah, Kansas, Missouri, and Tennessee.

2. LUDWIGIA: *Water-primrose, False-loosestrife*

- a. Petals and sepals 4-7; stamens 2-times number of sepals, at least 8 or more. (The following are often included in the genus *Jussiaea*.)
  - b. Leaves strongly decurrent; capsule obpyramidal; raphie of seed distinctly smaller than seed body....1. *L. decurrens*
  - b. Leaves not decurrent; capsule not obpyramidal; raphie enlarged and equaling body of seed.
  - c. Flowers mostly 4-merous; seeds multiseriate in each locule.....2. *L. octovalis*
  - c. Flowers 5 or 6-merous; seeds uniseriate in each locule.
    - d. Branches erect; seeds free in the endocarp.....3. *L. leptocarpa*
    - d. Branches prostrate (but perhaps with erect flowering stems); seeds adnate to pericarp.
      - e. Flowering stems erect; bracteoles lanceolate..
        - .....4. *L. uruguayensis*
      - e. Flowering stems floating or creeping; bracteoles deltoid.....5. *L. peploides*
  - a. Petals 0-4; sepals 4; stamens usually 4.
  - f. Leaves alternate.
    - g. Capsule pedicellate.
      - h. Leaves petiolate or with attenuate bases; stylopodium low, rounded.....6. *L. alternifolia*
      - h. Leaves sessile; stylopodium prominent, dome-shaped.
        - i. Lowermost leaves glabrous or puberulent; style over 6 mm long.....7. *L. virgata*
        - i. Lowermost leaves pubescent or hirsute; style less than 6 mm long.
          - j. Capsule appressed-pubescent; sepals ovate....8. *L. maritima*
          - j. Capsule erect-hirsute; sepals narrowly deltoid..
            - .....9. *L. hirtella*
      - g. Capsule sessile or subsessile.
        - k. The capsule at least 2-times as long as broad.
          - l. Leaves lanceolate; petals absent; bracteoles less than 1 mm long.....10. *L. glandulosa*
          - l. Leaves linear; petals present; bracteoles more than 1 mm long.
            - m. Capsule long-obconical; sepals narrowly deltoid; seeds light tan.....11. *L. linearis*
            - m. Capsule cylindric; sepals linear; seeds dark brown.....12. *L. linifolia*
        - k. The capsule about as long as broad.
          - n. Bracteoles less than 2 mm long.
            - o. Cauline leaves linear to narrowly ovate; capsule round, over 2 mm long.....13. *L. sphaerocarpa*
            - o. Cauline leaves obovate to spatulate; capsule obpyramidal, less than 2 mm long.....14. *L. microcarpa*
          - n. Bracteoles at least 2 mm long.
            - p. Plant pilose; upper leaves elliptic.....15. *L. pilosa*
            - p. Plant glabrous except for the stolons; upper leaves lance-linear.
              - q. Flowers in terminal heads; capsule rounded..
                - .....16. *L. suffruticosa*
              - q. Flowers not in heads; capsule winged.



EPILOBIUM

LUDWIGIA



*E. coloratum*



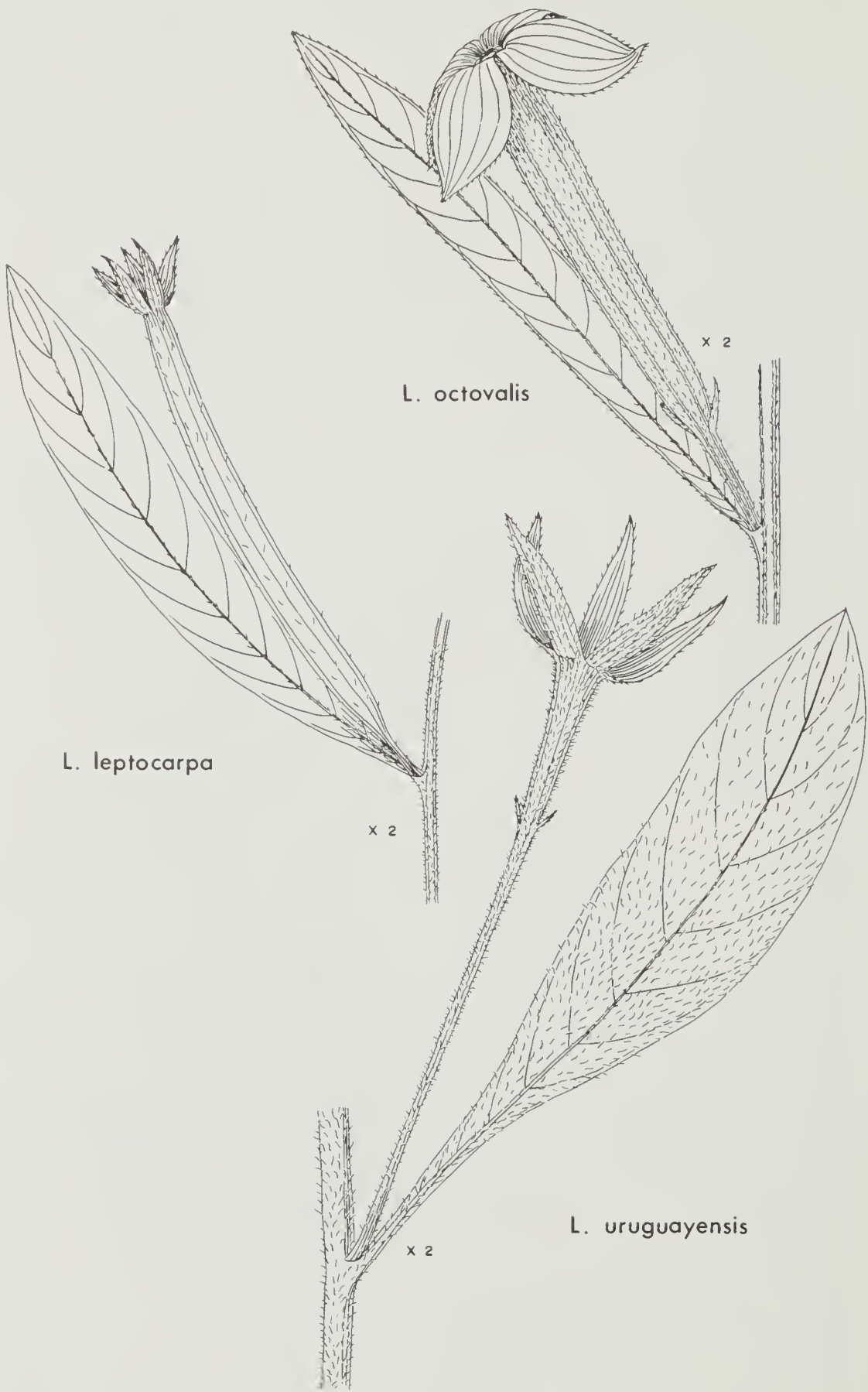
*E. leptophyllum*



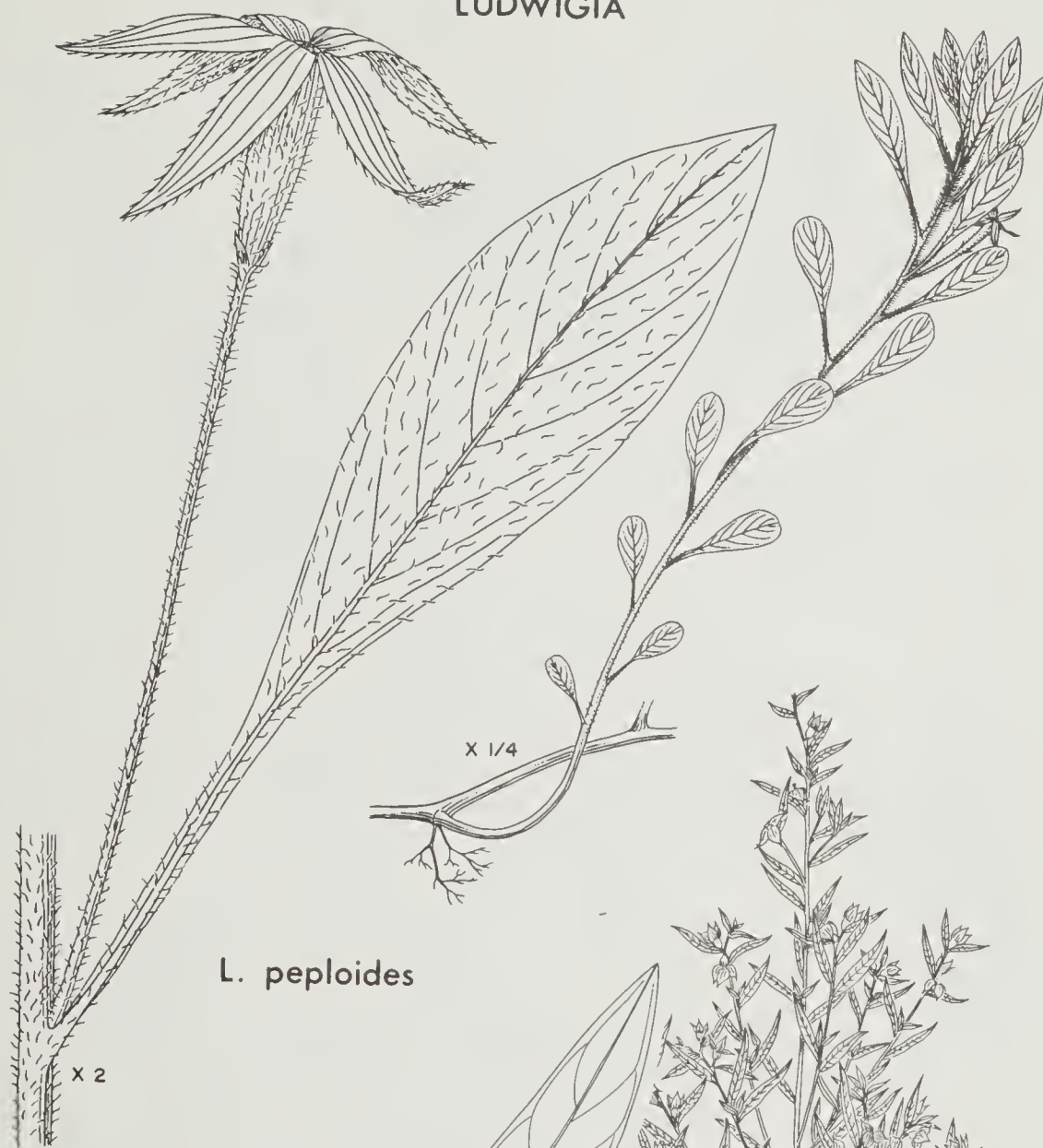
*L. decurrens*



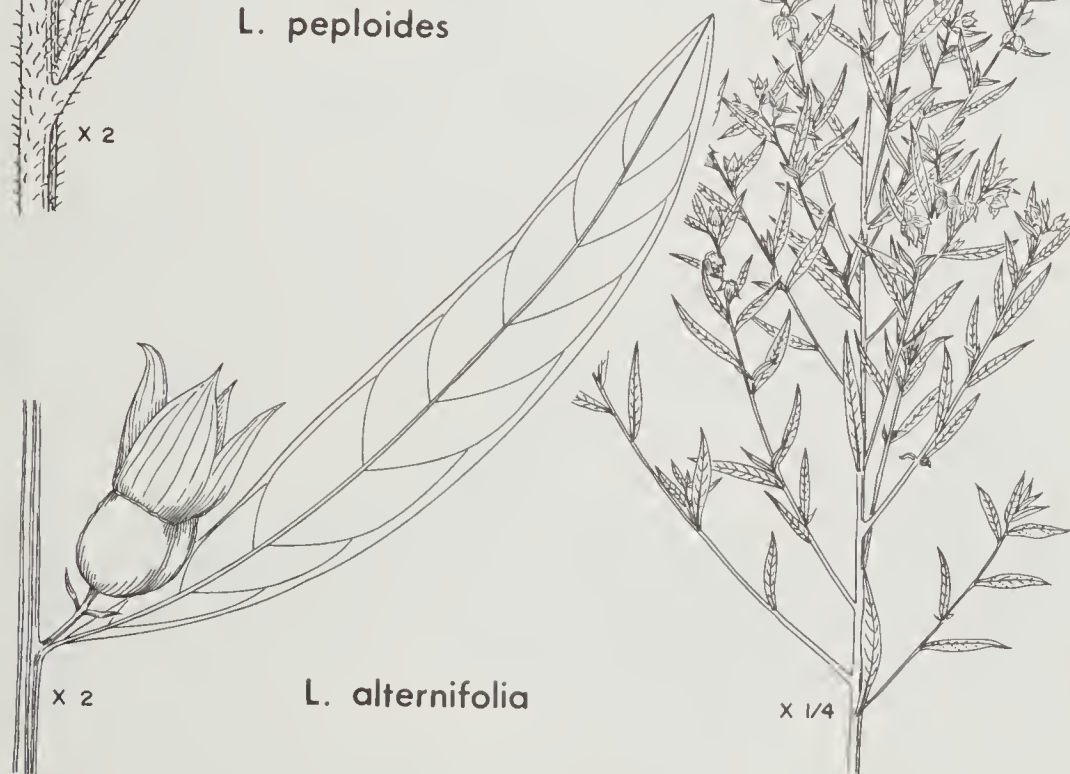
LUDWIGIA



LUDWIGIA



*L. peploides*



*L. alternifolia*

# LUDWIGIA



*L. virgata*



*L. maritima*



*L. hirtella*



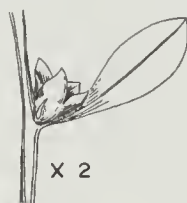
*L. glandulosa*



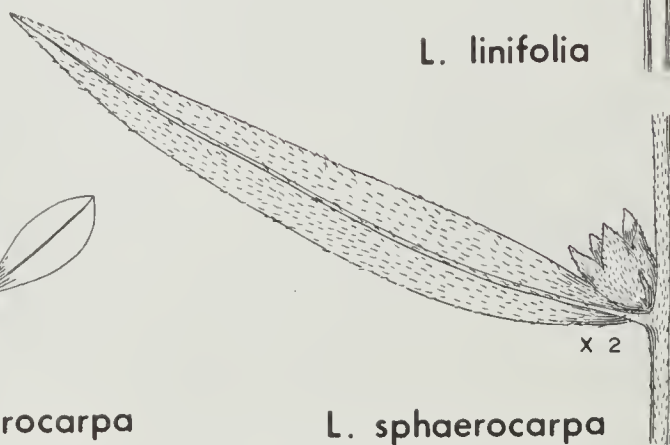
*L. linifolia*



*L. linearis*



*L. microcarpa*



*L. sphaerocarpa*



- r. Sepals nearly as long as capsule; seeds  
oval.....17. *L. alata*
- r. Sepals about one-half as long as capsule;  
seeds cylindric.....18. *lanceolata*
- f. Leaves opposite.
  - s. Capsule pedicellate.....19. *L. brevipes*
  - s. Capsule sessile or subsessile.
    - t. Petals present; capsule without longitudinal green  
strips; bracteoles 1.5-5 mm long, usually borne above  
the base of the capsule.....20. *L. repens*
    - t. Petals absent; capsule with longitudinal green  
strips; bracteoles usually less than 1 mm long,  
basal.....21. *L. palustris*

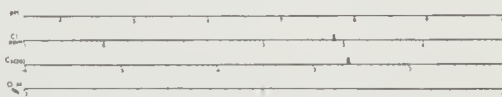
1. *Ludwigia decurrens* Walt.

Common in low ground, ditches, and marshes throughout North Carolina. Extending northward into Virginia, southward into Florida and westward into West Virginia, Indiana, Illinois, Missouri, Oklahoma, and Texas. [*Jussiaea decurrens* (Walt.) DC.]



2. *Ludwigia octovalis* (Jacq.) Raven

Locally abundant in low ground and marshes in Brunswick and New Hanover counties of North Carolina. Extending, along the Atlantic and Gulf coasts, southward into Florida and Louisiana. [*Jussiaea suffruticosa* L., *L. bonariensis* in Vasc. Flora of the Carolinas, not (Mich.) Hara]



3. *Ludwigia leptocarpa* (Nutt.) Hara

Locally abundant in low ground, ponds, marshes, and ditches in the central and southern portions of the Coastal Plain and adjacent Piedmont of North Carolina. Extending, along the Coastal Plain, southward into Florida and Texas; Arkansas. [*Jussiaea leptocarpa* Nutt.]



4. *Ludwigia uruguayensis* (Camb.) Hara

Locally abundant in lakes, ponds, sluggish streams, marshes, and swamps in scattered locations in the Piedmont and Coastal Plain provinces of North Carolina. Extending northward into New York and southward, in coastal states, into Florida and Texas. [*Jussiaea uruguayensis* Camb., *J. michauxiana* Fern.]



5. *Ludwigia peploides* var. *glabrescens* (Kuntze) Shinnars

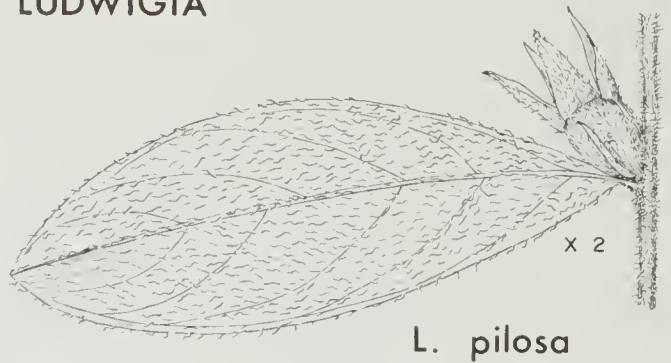
Very rare in low ground, ditches, lakes, and ponds in Mecklenburg, New Hanover, and Wilson counties of North Carolina. Extending from Indiana into Kansas and southward into Louisiana and Texas; with widely scattered (probably introduced) locations in New Jersey, Pennsylvania, and Maryland. [*Jussiaea diffusa* Forsk., *J. grandiflorus* Michx., *J. repens* var. *glabrescens* Kuntze, *J. repens* L., *Ludwigia adscendens* (L.) Hara]



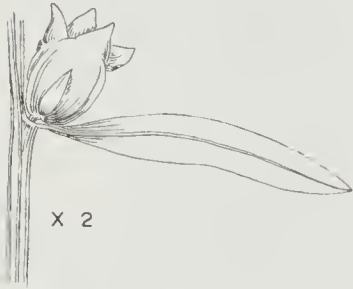
# LUDWIGIA



*L. suffruticosa*



*L. pilosa*



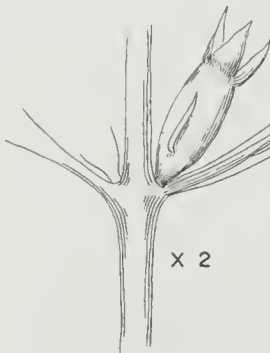
*L. lanceolata*



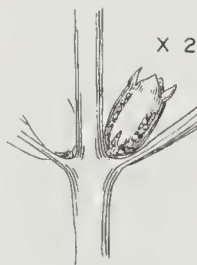
*L. brevipes*



*L. alata*



*L. repens*



*L. palustris*



6. *Ludwigia alternifolia* L.

Common in low ground, ditches, marshes, and swamps throughout North Carolina. Extending northward into Massachusetts, southward into Florida and westward into New York, Michigan, Illinois, Kansas, and Texas.



7. *Ludwigia virgata* Michx.

Frequent in low ground and bogs chiefly in the southern half of the Coastal Plain of North Carolina. Extending northward into Virginia and southward, along the Atlantic and Gulf coastal states, into Florida and Mississippi.

8. *Ludwigia maritima* Harper

Frequent in low pinelands and ditches in the southeastern half of the Coastal Plain of North Carolina. Extending southward, in Atlantic and Gulf coastal states, into Florida and Mississippi.

9. *Ludwigia hirtella* Raf.

Frequent in low pinelands, ditches, and swamps chiefly in the Coastal Plain and adjacent Piedmont of North Carolina. Extending northward into New Jersey, southward into Florida and westward into Kentucky, Arkansas, and Texas.

10. *Ludwigia glandulosa* Walt.

Frequent in low woods and shallow water of swamps and marshes in the Piedmont and Coastal Plain provinces of North Carolina. Extending northward into Virginia, southward into Florida and westward into Indiana, Illinois, Kansas, Missouri, and Texas.



11. *Ludwigia linearis* Walt.

Frequent in low pinelands or shallow water of bogs, swamps, and ditches chiefly in the Coastal Plain of North Carolina. Extending northward into New Jersey and southward, chiefly in the Coastal Plain of Atlantic and Gulf states, into Florida and Texas; Tennessee and Alabama.

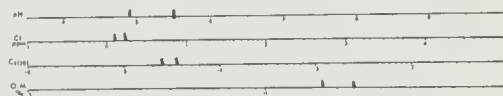


12. *Ludwigia linifolia* Poir.

Very rare in ditches, swamps, and bogs in Brunswick and New Hanover counties of North Carolina. Extending southward, in the Coastal Plain of Atlantic and Gulf states, into Florida and Mississippi.

13. *Ludwigia sphaerocarpa* Ell.

Locally abundant in low ground and shallow water of bogs, ponds, and swamps in the Coastal Plain of North Carolina. Extending northward into Massachusetts, southward into Florida and, along the Gulf coastal states, into Texas; Michigan and Indiana.

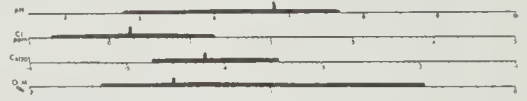


14. *Ludwigia microcarpa* Michx.

Rare in low ground, ditches, swamps, and marshes chiefly in the outer Coastal Plain of North Carolina. Extending southward, in the Coastal Plain, into Florida and Louisiana; Missouri and Tennessee.

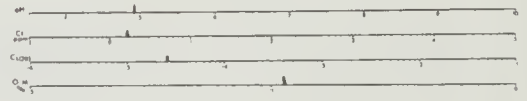
15. *Ludwigia pilosa* Walt.

Frequent in low ground, ditches, and shallow water of pools in the Coastal Plain of North Carolina. Extending, in the Coastal Plain, northward into Virginia and southward into Florida and Texas.



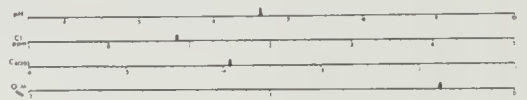
16. *Ludwigia suffruticosa* Walt.

Locally abundant in wet pinelands and pond margins in the extreme south-eastern Coastal Plain of North Carolina. Extending, in the Coastal Plain, southward into Florida and Mississippi.



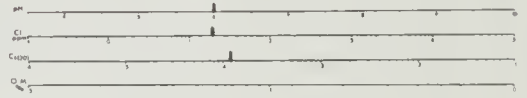
17. *Ludwigia alata* Ell.

Rare in swamps, marshes, and tidal swales in the outer Coastal Plain of North Carolina. Extending, in the outer Coastal Plain, northward into Virginia and southward into Florida and Louisiana; Missouri. [*L. simulata* Small]



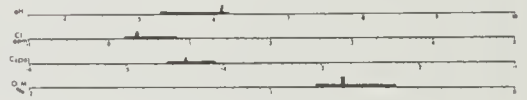
18. *Ludwigia lanceolata* Ell.

Rare in brackish ditches and marshes in Brunswick and Dare counties of North Carolina. Extending, in the outer Coastal Plain, southward into Florida and Mississippi.



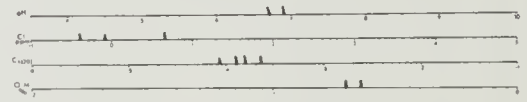
19. *Ludwigia brevipes* (Long) Eames

Locally abundant on wet soil and in shallow water of ditches, lakes, and marshes in the Coastal Plain of North Carolina. Extending, in the Coastal Plain, northward into New Jersey and southward into Florida.



20. *Ludwigia repens* Forster

Locally abundant in low ground or shallow water of ditches and pools in the outer Coastal Plain of North Carolina. Extending, in the Coastal Plain, southward into Florida and Texas; Tennessee, Missouri, and California. [*Isnardia repens* (Swartz) DC., *Ludwigia natans* Ell.]



21. *Ludwigia palustris* (L.) Ell.

Common on mud and in shallow water in ditches, pond margins, and marshes throughout North Carolina. Extending throughout the eastern half of the United States; Arizona, Wyoming, and the Pacific coastal states. [*Isnardia palustris* L.]



- a. Flowers 4-merous; emerged leaves of most species bract-like and reduced in size; leaves whorled or alternate...1. *Myriophyllum*
- a. Flowers 3-merous; emerged leaves foliaceous; leaves alternate.....2. *Proserpinaca*

1. MYRIOPHYLLUM: *Water-milfoil*

- a. Leaves all similar whether submersed or emergent. (This part of the key is useful for vegetative plants.)
  - b. Plants with emergent leaves as well as submersed leaves; leaf segments in 6-18 pairs, feather-like..1. *M. brasiliense*
  - b. Plants with submersed parts only.
    - c. Segments of leaf 6-18 in number; all leaves whorled.
      - d. Rachis of leaf broadened toward the base; segments also with broadened bases.....2. *M. heterophyllum*
      - d. Rachis of leaf thread-like and of nearly equal diameter throughout; segments also thread-like..3. *M. exalbescens*
    - c. Segments of leaf 3-8 in number; some submersed leaves whorled, others scattered.
      - e. Submersed leaves in whorls of 3 or 4.....4. *M. laxum*
      - e. Submersed leaves in whorls of 3-6 and often scattered.....5. *M. pinnatum*
  - a. Leaves of submersed and emergent portions dissimilar although perhaps grading from one to the other. (This part of the key is useful for plants with flowering or fruiting portions.)
    - f. Emergent leaves at base of flowers or fruits 1-5 mm long.
      - g. Leaves at base of fruits barely equalling fruit length, the lower serrate, the upper entire.....3. *M. exalbescens*
      - g. Leaves at base of fruits exceeding fruit length, the lower pinnately cleft, becoming entire and spatulate above.....4. *M. laxum*
    - f. Emergent leaves at base of flowers or fruits 5-25 mm long.
      - h. Leaves at base of flowers or fruits serrate; stamens 4.....2. *M. heterophyllum*
      - h. Leaves at base of flowers or fruits pinnate; stamens 8.....5. *M. pinnatum*

1. *Myriophyllum brasiliense* Camb., *Parrot-feather*

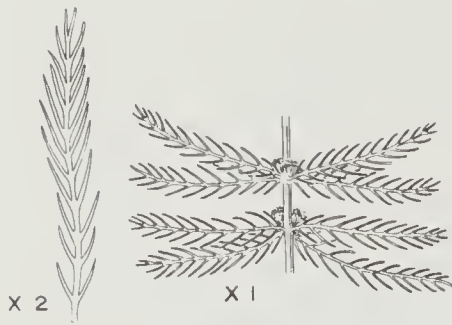
Locally abundant as an aggressive introduction in lakes, ponds, and ditches in the eastern portion of the Piedmont and in the Coastal Plain, but

less frequent elsewhere in North Carolina. Extending northward into New York, southward into Florida and westward into West Virginia, Missouri, Kansas, New Mexico, and Arizona. [*M. proserpinacoides* Gill.]

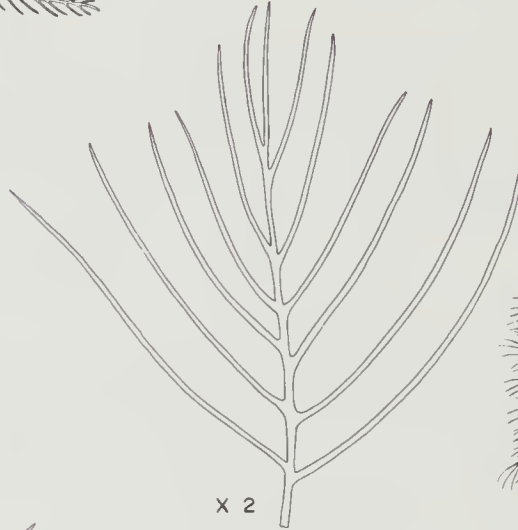




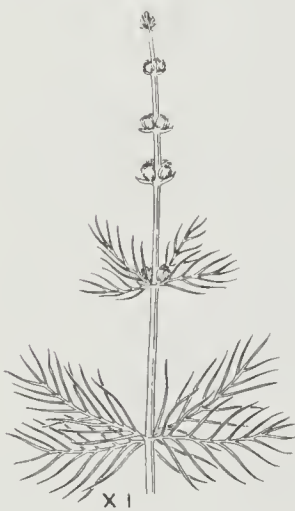
# MYRIOPHYLLUM



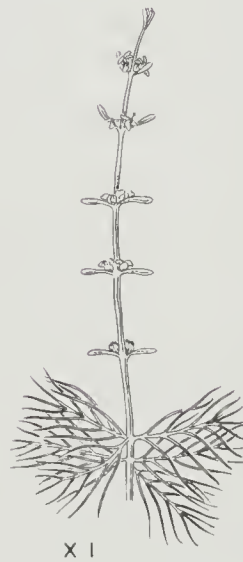
*M. brasiliense*



*M. heterophyllum*



*M. exalbescent*



*M. laxum*

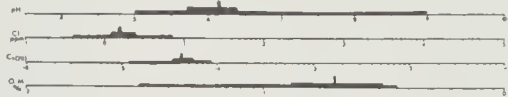


*M. pinnatum*



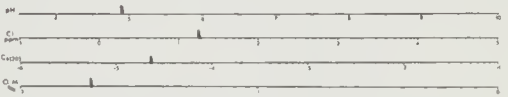


2. *Myriophyllum heterophyllum* Michx.  
 Common in ponds, ditches, and streams in the Coastal Plain and extreme eastern Piedmont of North Carolina. Extending throughout the United States.

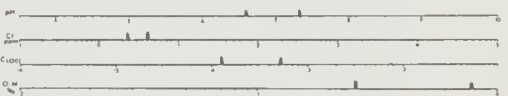


3. *Myriophyllum exalbescens* Fern.  
 Rare in sluggish streams in Tyrrell County, North Carolina. This species is common throughout the United States except in the Southeast. The station in North Carolina and another in South Carolina appear to be recent introductions.

4. *Myriophyllum laxum* Shut. & Chap.  
 Rare in shallow pools in Brunswick and Craven counties of North Carolina. Extending southward into Georgia, Florida, and Alabama.



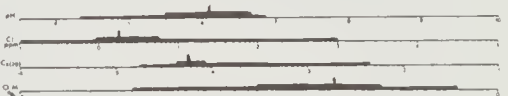
5. *Myriophyllum pinnatum* (Walt.) BSP.  
 Infrequent in shallow water and damp margins of ditches and pools in the Coastal Plain of North Carolina. Extending northward into Massachusetts, southward into Florida and westward into Ohio, Illinois, Iowa, Nebraska, Kansas, Oklahoma, and Texas. [*M. scabratum* Michx.]



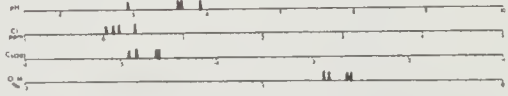
2. PROSERPINACA: Mermaid-weed

- a. Emerged leaves serrate on flowering plants; usually with pectinately divided leaves on the vegetative portion of the plant.....1. *P. palustris*
- a. Emerged leaves pinnately lobed; no leaves serrate.
  - b. Median portion of emerged blade more than 1 mm wide..
    - .....2. *P. intermedia*
  - b. Median portion of emerged blade less than 1 mm wide..
    - .....3. *P. pectinata*

1. *Proserpinaca palustris* L.  
 Common on wet shores and in shallow water of ditches, ponds, and marshes in the Piedmont and Coastal Plain provinces of North Carolina. Extending throughout the eastern half of the United States. [*P. amblygona* (Fern.) Small, *P. platycarpa* Small]

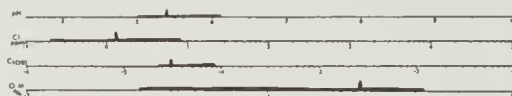


2. *Proserpinaca intermedia* Mack.  
 Locally abundant in ditches and marshes of Harnett, Moore, Scotland, and Richmond counties of North Carolina. Extending northward into Massachusetts and southward into South Carolina; Tennessee.



3. *Proserpinaca pectinata* Lam.

Locally abundant in ditches, bogs, and low ground chiefly in the Coastal Plain of North Carolina. Extending, along the Coastal Plain, northward into Maine and southward into Florida and Texas.



--APIACEAE (UMBELLIFERAE)--

- a. Leaves all simple.
  - b. Plant prostrate; leaves and peduncles arising from a horizontal stem (rhizome).
    - c. Leaves linear, septate.....1. *Lilaeopsis*
    - c. Leaves with broadly rounded to ovate blades, not septate.
      - d. Blade of leaf peltate, or round in outline with large basal lobes, the petiole centrally attached; involucre bracts much reduced or absent.....2. *Hydrocotyle*
      - d. Blade of leaf ovate, attached basally; involucre bracts 2, conspicuous.....3. *Centella*
  - b. Plant with erect leafy stems.
    - e. Leaf blades flat, linear to oblanceolate, serrate to undulate.....4. *Eryngium*
    - e. Leaf reduced to septate phyllode.
      - f. Basal leaves up to 4 dm long; involucre bracts 4-9 mm long; rays 2 or more cm long; fruit dorsally flattened, with lateral wings; roots fascicled.....5. *Oxypolis*
      - f. Basal leaves less than 2 dm long; involucre bracts absent or less than 5 mm long; rays 0.5-1.2 cm long; fruit subterete, without wings; roots not fascicled.....6. *Ptilimnium*
- a. Leaves, at least some, compound or at least deeply dissected.
  - g. Blade of leaf no more than once compound.
    - h. Leaflet serrate throughout.....7. *Sium*
    - h. Leaflet entire or with a few large teeth localized toward upper half.....5. *Oxypolis*
  - g. Blade of leaf more than once compound or at least few-to-several times deeply lobed.
    - i. Ultimate divisions of the leaf filiform; roots not fascicled.....6. *Ptilimnium*
    - i. Ultimate divisions of the leaf flat, broad, serrate; roots with a fascicle of tubers near the stem base.....8. *Cicuta*

1. LILAEOPSIS

- a. Fruit with all ribs corky-thickened; leaves 7-30 cm long, exceeding the peduncles.....1. *L. carolinensis*
- a. Fruit with only lateral ribs corky-thickened; leaves 1-5 cm long, equal to or shorter than the peduncles...2. *L. chinensis*

1. *Lilaeopsis carolinensis* C. & R.

Infrequent and very local in shallow pools and freshwater marshes near the coast in Brunswick, Currituck, and Dare counties of North Carolina. Extending northward into Virginia and southward, in coastal areas, into Florida and Louisiana. [*L. attenuata* (H. & A.) Fern.]

PROSERPINACA

LILAEOPSIS



*P. palustris*

X 1

*L. chinensis*



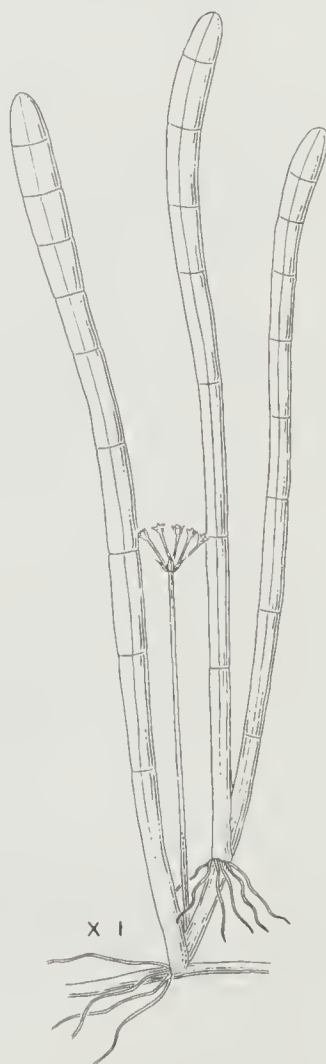
X 1/2

*P. intermedia*



X 1/2

*P. pectinata*



X 1

*L. carolinensis*

2. *Lilaeopsis chinensis* (L.) Kuntze

Very local in brackish marshes in the outer Coastal Plain of North Carolina. Extending, along the coast, northward into Maine and southward into Florida and Louisiana. [*L. lineata* (Michx.) Greene]

2. HYDROCOTYLE: *Water-pennywort*

a. Leaf cleft to the petiole.

b. Umbel sessile or nearly so; stem and petioles delicate; leaves thin, shallowly notched.....1. *H. americana*

b. Umbel long-stalked; stem and petioles fleshy; leaves thick, deeply notched, the terminal lobe distinct..  
.....2. *H. ranunculoides*

a. Leaf peltate.

c. Inflorescence consisting of one umbellate cluster (rarely weakly proliferating).....3. *H. umbellata*

c. Inflorescence consisting of several definite clusters.

d. Base of fruit notched; inflorescence a proliferating umbel often with verticillate flowers on the branches.....4. *H. bonariensis*

d. Base of fruit rounded to flat; inflorescence verticillate, occasionally weakly proliferating above.....5. *H. verticillata*

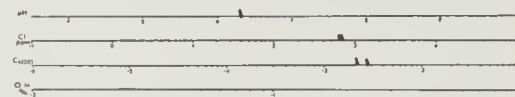
1. *Hydrocotyle americana* L.

Rare on moist soil and in bogs in the Blue Ridge Province of North Carolina. Extending northward into Maine, southward into South Carolina and westward into Minnesota, Indiana, and Tennessee.



2. *Hydrocotyle ranunculoides* L.f.

Rare in ponds, stream margins, and swamps in the outer Coastal Plain of North Carolina. Extending northward into Pennsylvania and Delaware, southward into Florida and thence westward into Texas, Arkansas, and Oklahoma; New Mexico, Arizona, California, Oregon, and Washington.



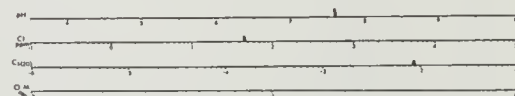
3. *Hydrocotyle umbellata* L.

Frequent in low ground, pond margins, and ditches in the Coastal Plain and adjacent portion of the Piedmont of North Carolina. Extending northward into New England, southward into Florida and westward into Minnesota and Texas; Pacific coastal states.

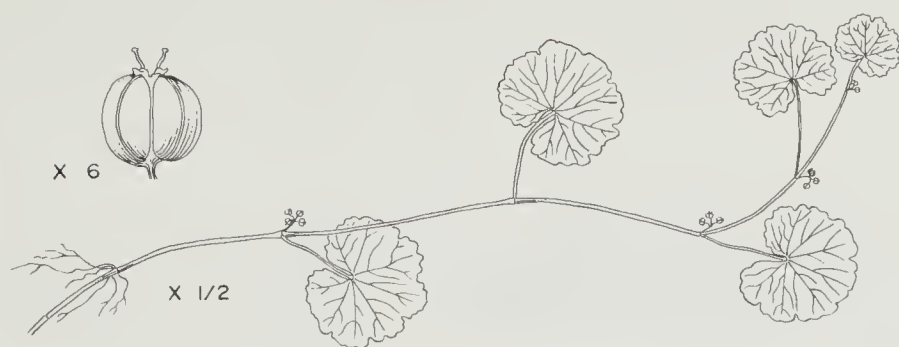


4. *Hydrocotyle bonariensis* Lam.

Common in wet sandy ditches, swales, and ponds in the outer Coastal Plain of North Carolina. Extending, along the Atlantic and Gulf coasts, into Florida and Texas.



# HYDROCOTYLE



*H. americana*



*H. ranunculoides*

*H. umbellata*

*H. bonariensis*



5. *Hydrocotyle verticillata* Thund.

Frequent in low ground, bogs, and swamps chiefly in the Coastal Plain of North Carolina. Extending northward into New England, southward into Florida and thence westward into Texas, Oklahoma, Missouri, and Arkansas; Utah, Arizona, California, and Oregon.

3. CENTELLA

1. *Centella asiatica* (L.) Urban

Common in moist sandy swales as well as marsh and pond margins in the southern and outer Coastal Plain of North Carolina. Extending, along the Atlantic coast, from Delaware into Florida and westward, along the Gulf coast, into Texas. [*C. repanda* (Pers.) Small, *C. erecta* (L.f.) Fern.]

4. ERYNGIUM: *Eryngo*

1. *Eryngium aquaticum* L.

Locally abundant in swales, ditches, pond margins, and marshes, often brackish, in the outer Coastal Plain of North Carolina. Extending northward into New Jersey and southward into Florida and Alabama; Texas. [*E. virginianum* Lam.]

5. OXYPOLIS: *Hog-fennel*

a. Leaves reduced to hollow, terete, transversely-jointed  
petioles without blades.....1. *O. filiformis*

a. Leaves with blades.

b. Blades simple or with 3 leaflets, parallel veined.....2. *O. ternata*

b. Blades pinnately divided, net veined.....3. *O. rigidior*

1. *Oxypolis filiformis* (Walt.) Britt.

Infrequent in low ground and margins of ponds in the southern portion of the Coastal Plain of North Carolina. Extending southward into Florida and thence westward into Texas.

2. *Oxypolis ternata* (Nutt.) Heller

Infrequent in low ground and bog margins in the Sand Hills and outer Coastal Plain of North Carolina. Extending northward into Virginia, southward into Florida and thence westward into Mississippi.

3. *Oxypolis rigidior* (L.) Raf.

Low ground, bogs, stream margins, marshes, and swamps throughout North Carolina but more frequent westward. Extending throughout the eastern half of the United States except in the New England states. [*O. turgida* Small]

6. PTILIMNIUM: *Mock Bishop's-weed*

a. Leaves reduced to simple, terete, hollow, septate phyllodes;  
involucral bracts absent or at most less than 5 mm long..

.....1. *P. fluviatile*

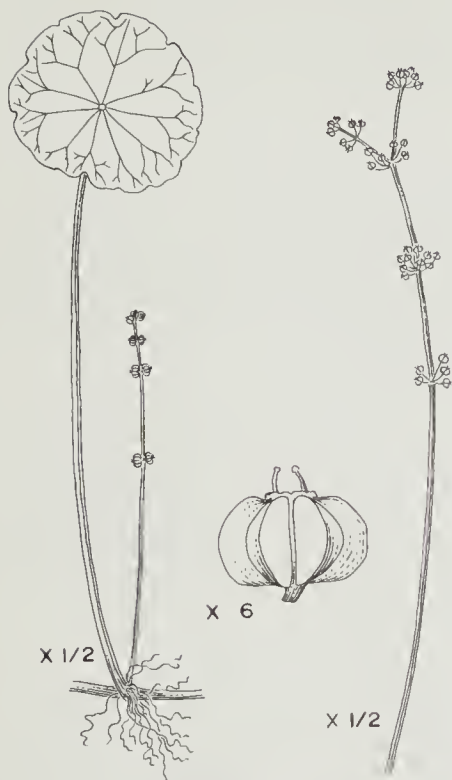
a. Leaves few-to-several times pinnately divided with  
numerous filiform segments; involucral bracts at

least 5 mm long.....2. *P. capillaceum*

# HYDROCOTYLE

# CENTELLA

# ERYNGIUM



*H. verticillata*



*C. asiatica*



*E. aquaticum*

OXYPOLIS

PTILIMNIUM



O. ternata

O. filiformis



P. fluviatile



P. capillaceum

1. *Ptilimnium fluviatile* (Rose) Mathias  
Very rare along rocky stream beds and sandbars in Chatham and Granville counties of North Carolina. Extending northward into Maryland and West Virginia and southward into the uplands of Alabama. [*Harperella fluviatilis* Rose, *P. viviparum* (Rose) Mathias]

2. *Ptilimnium capillaceum* (Michx.) Raf.  
Common in low ground, ditches, and marshes in the Piedmont and Coastal Plain provinces of North Carolina. Extending northward into Massachusetts, southward into Florida and westward into Illinois, Missouri, Oklahoma, and Texas; South Dakota.

7. SIUM: *Water-parsnip*

1. *Sium suave* Walt.  
Widely distributed in low ground, marshes, swamps, and stream margins in the Piedmont and Coastal Plain provinces (more abundant to the east) of North Carolina. Extending throughout the United States. [*S. cicutae-folium* Schrank]

8. CICUTA: *Water-hemlock*

1. *Cicuta maculata* L. *Spotted Cowbane*  
Common in low ground, marshes, swamps, ditches, and stream banks throughout North Carolina. Extending throughout the eastern half of the United States. The tuber-like roots are highly poisonous. [Includes *C. mexicana* C. & R.]

--CORNACEAE--

1. CORNUS: *Dogwood*

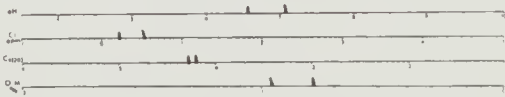
1. *Cornus amomum* Miller, *Red-willow*  
Common in low woodlands, marshes, and swamps throughout North Carolina but less frequent toward the east. Extending northward into Maine, southward into Alabama and westward into Indiana, Tennessee, and Mississippi. [*Svida amomum* (Miller) Small]

--PRIMULACEAE--

- a. Plant a floating aquatic but rooted in the substrate; submersed leaves deeply divided; stems inflated.....1. *Hottonia*
- a. Plant rooted in the substrate and erect, quasi-aquatic; leaves simple; stem not inflated.
  - b. Leaves almost all opposite, not in a basal rosette; pedicel with a bract at base.....2. *Lysimachia*
  - b. Leaves in a basal rosette and alternate on the stem; pedicel with a bract near the middle.....3. *Samolus*

1. HOTTONIA: *Featherfoil, Water-violet*

1. *Hottonia inflata* Ell.  
Sporadic in ponds, sloughs, and sluggish streams in the northeastern Coastal Plain of North Carolina. Extending northward into Maine, southward



SIUM      CICUTA      CORNUS



*Ci. maculata*

*S. suave*

*Co. amomum*



into Florida and westward into New York, Ohio, Indiana, Illinois, Missouri, and Texas.

2. LYSIMACHIA: Loosestrife

1. *Lysimachia terrestris* (L.) BSP. Swamp Loosestrife

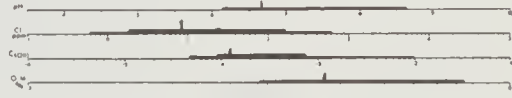
Frequent in low ground, wet shores, bogs, and swamps chiefly in the Blue Ridge Province but widely scattered in the Piedmont and Coastal Plain provinces of North Carolina. Extending northward into Maine, southward into Georgia and westward into Minnesota, Iowa, Arkansas, and Mississippi.



3. SAMOLUS: Water-pimpernel, Brookweed

1. *Samolus parviflorus* Raf.

Frequent in muddy seeps, stream banks, and marshes chiefly in the Coastal Plain but less frequently in the Piedmont of North Carolina. Extending throughout the United States. [*S. floribundus* HBK.]



--PLUMBAGINACEAE--

1. LIMONIUM: Sea Lavender

1. *Limonium carolinianum* (Walt.) Britt.

Common in brackish and salt marshes in the outer Coastal Plain of North Carolina. Extending, along the Atlantic and Gulf coasts, from New England to Texas. [Includes *L. obtusilobum* Blake, *L. nashii* Small, *L. angustatum* (Gray) Small]

--LOGANIACEAE--

1. CYNOCTONUM: Miterwort

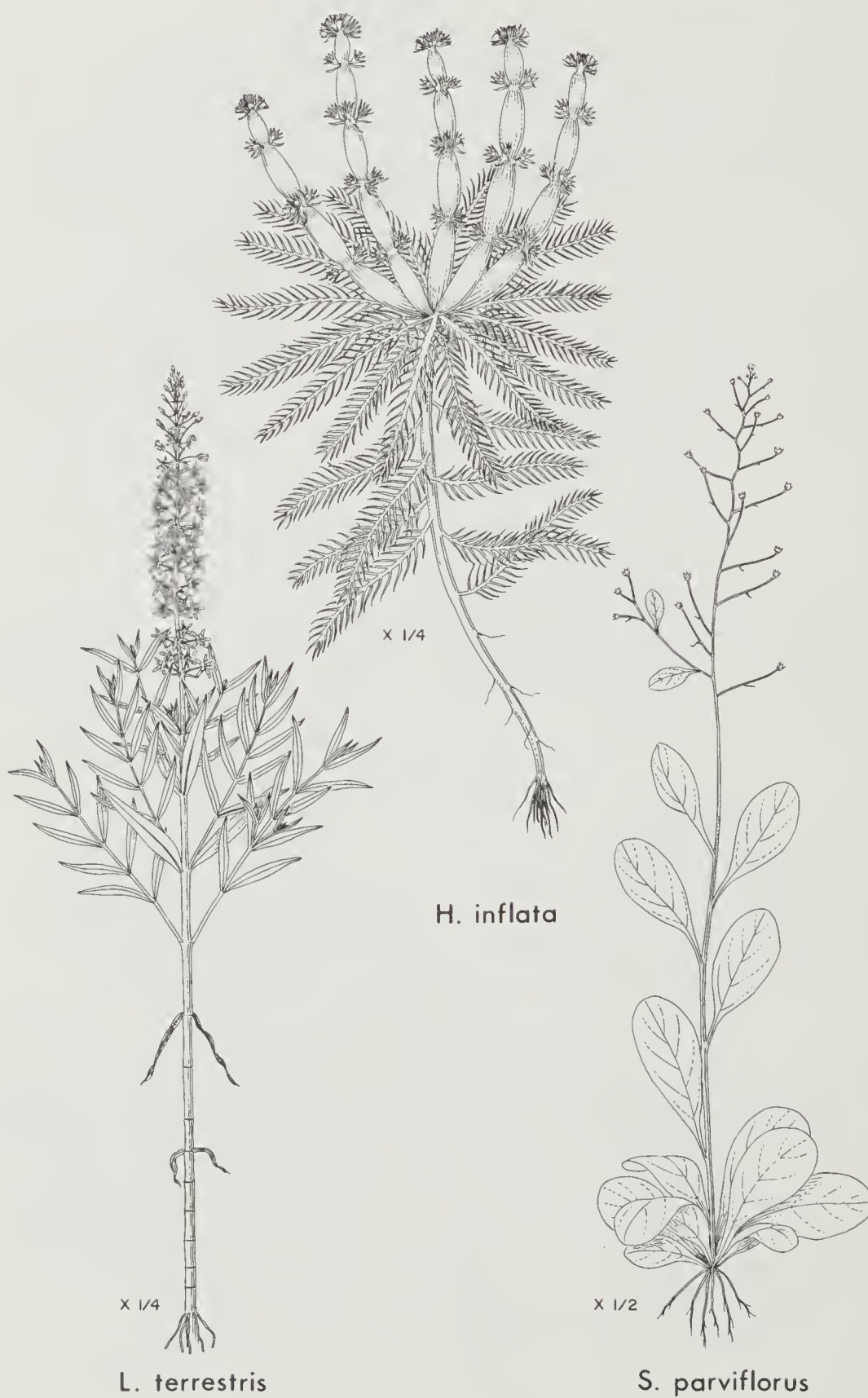
1. *Cynoctonum mitreola* (L.) Britt.

Infrequent in wet soil, swamps, and marshes chiefly in the outer Coastal Plain but rare in the Piedmont of North Carolina. Extending northward into Virginia, southward into Florida and westward into Tennessee, Arkansas, and Texas.

--GENTIANACEAE--

- a. Plant a floating aquatic but rooted in the substrate; leaves cordate, petiolate from a long, petiole-like stem which terminates in a fascicle of flowers.....1. *Nymphoides*
- a. Plant quasi-aquatic with self-supporting leaves and stem.
  - b. Leaves scale-like, 5 mm or less in length.....2. *Bartonia*
  - b. Leaves longer than 6 mm.
    - c. Leaf trifoliolate.....3. *Menyanthes*
    - c. Leaf simple.
      - d. Corolla lobes much longer than the tube, pink to white; fruit turgid.....4. *Sabatia*

HOTTONIA    LYSIMACHIA    SAMOLUS



LIMONIUM

CYNOCTONUM



*L. carolinianum*



*C. mitreola*

- d. Corolla lobes shorter than the tube, blue to white;  
fruit laterally compressed.....5. *Gentiana*

## 1. NYMPHOIDES: *Floating-heart*

- a. Floating leaves usually more than 4 cm broad, suborbicular to reniform, the lower surface usually thickened and densely dark-pitted; petiole and stem 1.3-2.5 mm thick, densely covered with dark glands; sepals densely covered with dark glands; upper surface of leaves (except where diseased) green; seed with a tuberculate surface.....1. *N. aquatica*
- a. Floating leaves less than 5 cm broad, cordate, thin, the lower surface not densely dark-pitted; petiole and stem 0.8 mm or less in diameter, sparsely, if at all, covered with dark glands; upper surface of leaves green but mottled with purple; seed with smooth surface.....2. *N. cordata*

The following two species are, for the most part, well differentiated. However, plants in a pond on Juniper Run Creek 3 miles west of Parkers Mill exhibit the vegetative features of *N. cordata* but produce the distinctive tuberculate seeds of *N. aquatica* and are herein considered to be the latter species.

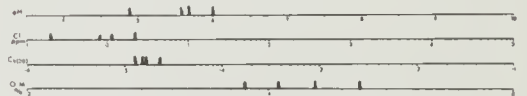
### 1. *Nymphoides aquatica* (Walt. ex J. F. Gmel.) Kuntze

Frequent in ponds and sluggish streams in the southern half of the Coastal Plain of North Carolina. Extending, in the Coastal Plain, from New Jersey into Florida and Texas.



### 2. *Nymphoides cordata* (Ell.) Fern.

Locally abundant in ponds and sluggish streams in the Sand Hills of North Carolina. Extending northward into Maine, southward into Florida, and westward into New York in the north and Louisiana in the south; Minnesota and Wisconsin. [*N. lacunosa* of Am. authors, not (Vent.) Kuntze]



## 2. BARTONIA

- a. Corolla lobes entire, tapering smoothly to a point; stems lax, frequently climbing; leaves usually alternate.....1. *B. paniculata*
- a. Corolla lobes often erose, ending in an abrupt point; stems stiff, never lax; leaves usually opposite.....2. *B. virginica*

### 1. *Bartonia paniculata* (Michx.) Muhl., *Screw-stem*

Infrequent in low ground, bogs, and marshes in the Coastal Plain of North Carolina. Extending northward into New England, southward into Florida and westward into Texas thence northward into Kentucky, Arkansas, and Oklahoma. [*B. lanceolata* Small]

### 2. *Bartonia virginica* (L.) BSP.

Infrequent in low ground, bogs, and marshes in widely scattered locations throughout North Carolina. Extending throughout the eastern half of the United States.

### 3. MENYANTHES: *Buckbean*, *Bogbean*

#### 1. *Menyanthes trifoliata* L.

Reported in a bog in Watauga County, North Carolina (specimen not seen). Extending across the northern half of the United States.

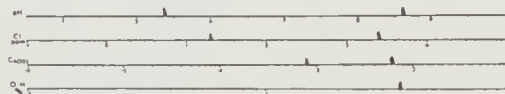
### 4. SABATIA: *Sabatia*

- a. Petals 5; plant an annual without rhizomes.....1. *S. stellaris*
- a. Petals 6 or more, usually 10 or more; plant perennial,  
rhizomatous.....2. *S. dodecandra*

Several species of *Sabatia* grow in low ground. Thus, if one of the above species is not clearly indicated a more comprehensive manual should be consulted.

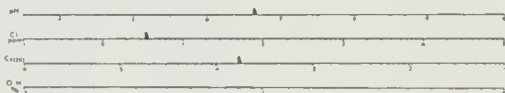
#### 1. *Sabatia stellaris* Pursh

Frequent in brackish marshes in the outer Coastal Plain of North Carolina. Extending northward into Massachusetts and southward, along the Atlantic and Gulf coasts, into Florida and Louisiana.



#### 2. *Sabatia dodecandra* (L.) BSP.

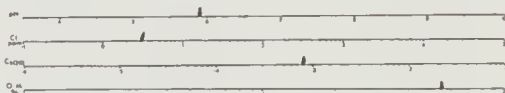
Frequent in low ground and marshes, sometimes brackish, in the outer Coastal Plain of North Carolina. Extending northward into Connecticut and southward, along the Atlantic and Gulf coasts, into Florida and Texas. [*S. harperi* Small, *S. kennedyana* Fern.]



### 5. GENTIANA: *Gentian*

#### 1. *Gentiana saponaria* L.

Infrequent in moist soil, bogs, swamps, and marshes throughout North Carolina except for the southern half of the Coastal Plain. Extending northward into New York, southward into Florida and westward into West Virginia, Indiana, Wisconsin, Minnesota, and Texas. [*Dasystephana saponaria* (L.) Small]



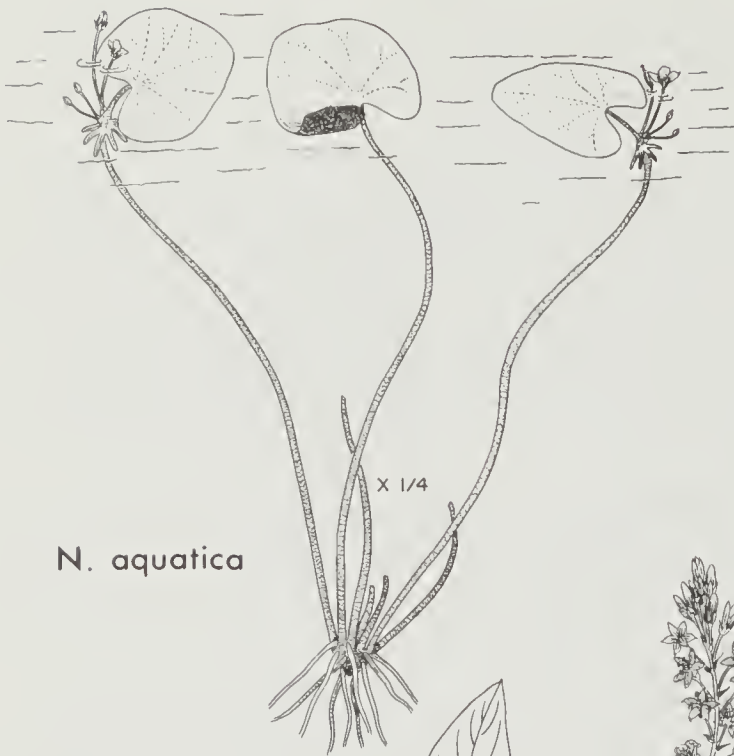
### --ASCLEPIADACEAE--

#### 1. ASCLEPIAS: *Milkweed*

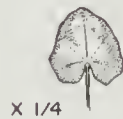
- a. Leaves narrow, at least 10-times as long as wide; horns of flowers not conspicuous, not extending beyond hood; umbels 1-4, terminal; corolla dull red.....1. *A. lanceolata*
- a. Leaves no more than 6-times as long as wide; horns of flower conspicuously exerted beyond hood; umbels several-to-many, axillary as well as terminal; corolla deep rose..  
.....2. *A. incarnata*



NYMPHOIDES      BARTONIA      MENYANTHES



*N. aquatica*



*N. cordata*



*B. paniculata*



*B. virginica*



*M. trifoliata*

SABATIA

GENTIANA



*S. stellaris*



*S. dodecandra*



*G. saponaria*

# ASCLEPIAS



*A. lanceolata*

1. *Asclepias lanceolata* Walt.

Infrequent in low ground, swamps, and marshes, both fresh and brackish, chiefly in the outer Coastal Plain of North Carolina. Extending, in the Coastal Plain, from New Jersey into Florida and Texas.

2. *Asclepias incarnata* L., Swamp Milkweed

Frequent in low ground, ditches, swamps, stream banks, and marshes in the Blue Ridge and Piedmont provinces and less frequent in the northern half of the Coastal Plain of North Carolina. Extending throughout the United States except in the extreme western states.

--HYDROPHYLLACEAE--

1. HYDROLEA

1. *Hydrolea quadrivalvis* Walt.

Frequent in muddy swamps, stream banks, and ponds chiefly in the Coastal Plain and less frequent in the southern portion of the Piedmont of North

Carolina. Extending northward into Virginia, southward into Florida and westward into Louisiana. [*Nama quadrivalve* (Walt.) Kuntze]



--BORAGINACEAE--

1. MYOSOTIS: *Forget-me-not*

- a. Corolla 5-10 mm broad; style at least as long as the nutlets;  
stem usually creeping and rooting at the nodes.....1. *M. scirpoides*
- a. Corolla 2-5 mm broad; style shorter than the nutlets;  
stem lax but not rooting at the nodes.....2. *M. laxa*

1. *Myosotis scirpoides* L.

Infrequent in low ground and along lakes and streams in the Blue Ridge Province of North Carolina. An introduction from Europe that has become established in much of the United States. [*M. palustris* (L.) Lam.]

2. *Myosotis laxa* Lehm.

Infrequent in low ground and along streams, ponds, and lakes in the Blue Ridge and northeastern Piedmont of North Carolina. Extending northward into New England, southward into Georgia and westward into Minnesota, Indiana, Ohio, and Tennessee; Pacific coastal states.

--VERBENACEAE--

- a. Inflorescence consisting of terminal (or terminal on axillary branches) elongate spikes.....1. *Verbena*
- a. Inflorescence consisting of axillary spikes which are very dense and capitate in flower but more elongate in fruit.....2. *Lippia*

1. VERBENA

- a. Flowers and fruits closely overlapping on the spikes....1. *V. hastata*
- a. Flowers and fruits more remotely spaced on the spikes.

ASCLEPIAS

HYDROLEA



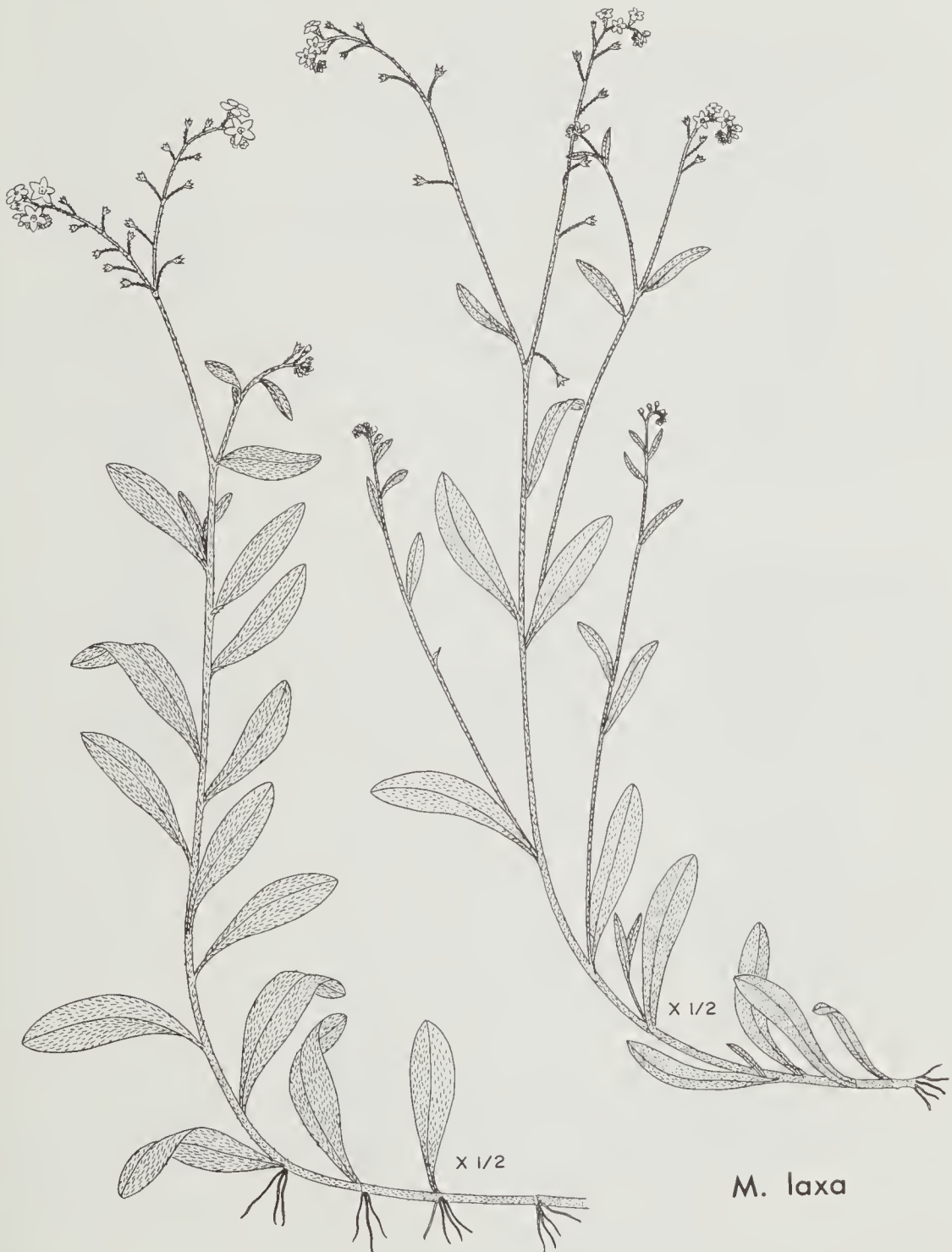
A. incarnata



H. quadrivalvis



MYOSOTIS



*M. scirpoides*

*M. laxa*

- b. Corolla white; apices of sepals not converging over nutlet.....2. *V. urticifolia*
- b. Corolla pink to lavender; apices of sepals converging over nutlet.....3. *V. scabra*

1. *Verbena hastata* L.

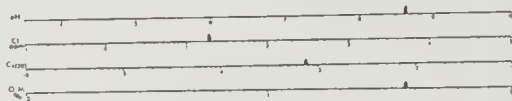
Infrequent in low ground, swales, bogs, and marshes in widely scattered localities throughout North Carolina. Extending throughout the United States except in the extreme southeast.

2. *Verbena urticifolia* L.

Common in low ground and marshes throughout North Carolina. Extending throughout the United States east of the Rocky Mountain states.

3. *Verbena scabra* Vahl

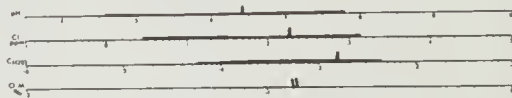
Infrequent in low ground, swales, marshes, swamps, and stream margins, often in brackish areas, in the outer Coastal Plain of North Carolina. Extending northward into Virginia, southward into Florida and westward into Texas, Arizona, and California.



2. LIPPIA

1. *Lippia lanceolata* Michx., Fog-fruit

Common in moist sandy soil and along the margins of swales and marshes in the outer Coastal Plain of North Carolina. Extending northward into New Jersey, southward into Florida and westward, in the north, into Minnesota, Nebraska and Kansas and, in the south, into Oklahoma and Texas; Arizona and California. [*Phyla lanceolata* (Michx.) Greene]



--LAMIACEAE (LABIATAE)--

- a. Anther-bearing stamens 2.....1. *Lycopus*
- a. Anther-bearing stamens 4.
  - b. Calyx with a distinct protuberance on top.....2. *Scutellaria*
  - b. Calyx without a protuberance.
    - c. Lobes of calyx 2-lipped.....3. *Macbridea*
    - c. Lobes of calyx all about equal, not 2-lipped.
      - d. Flowers solitary in the axil of each bracteal leaf.....4. *Dracocephalum*
      - d. Flowers 2-many in the axil of each bracteal leaf.
        - e. Plant aromatic, smelling of peppermint; stamens, at least some, protruding from the corolla.....5. *Mentha*
        - e. Plant not aromatic; stamens included within corolla.....6. *Stachys*

1. LYCOPUS: Water Horehound

- a. Calyx lobes shorter than the mature nutlets, obtuse to acute.....1. *L. virginicus*
- a. Calyx lobes longer than the mature nutlets, sharply acuminate.

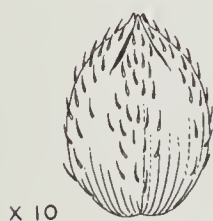
VERBENA

LIPPIA



X 1/4

*V. hastata*



X 10



X 1/2



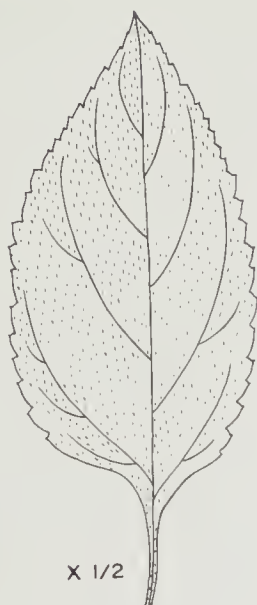
X 1/2

*V. scabra*

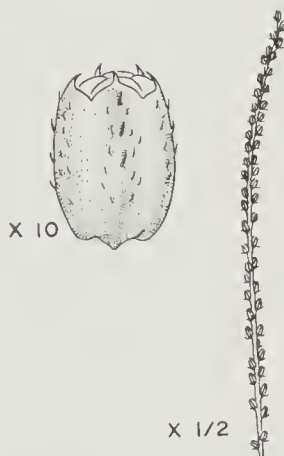


X 1/4

*L. lanceolata*



X 1/2



X 10

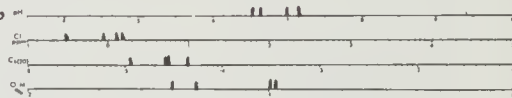
X 1/2

*V. urticifolia*

- b. Teeth of primary leaves 5 mm or more in length.
  - c. Leaves bearing multicellular hairs on the upper surface.....2. *L. europaeus*
  - c. Leaves glabrous or scabrous above, without multicellular hairs.....3. *L. americanus*
- b. Teeth of primary leaves 2 mm or less in length.
  - d. Leaf bases long-cuneate.....4. *L. rubellus*
  - d. Leaf bases wide and clasping.....5. *L. amplexans*

1. *Lycopus virginicus* L.

Common in moist soil of swamps, seeps, and margins of marshes throughout North Carolina. Extending northward into Maine, southward into Georgia and westward into Minnesota, Nebraska, Oklahoma, and eastern Texas.



2. *Lycopus europaeus* L.

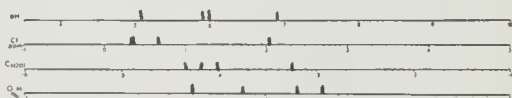
Rare in brackish marshes in Dare County, North Carolina. An introduction from Europe that has become established in local areas northward into Massachusetts.

3. *Lycopus americanus* Muhl. ex Bart.

Infrequent in low ground, swales, pond margins, and marshes in scattered localities in the Blue Ridge and Piedmont provinces of North Carolina. Extending throughout the United States.

4. *Lycopus rubellus* Moen.

Frequent in low ground, swales, pond margins, and marshes chiefly in the Coastal Plain and less frequent in the outer Piedmont of North Carolina. Extending throughout the eastern half of the United States.



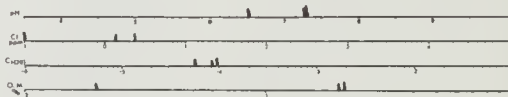
5. *Lycopus amplexans* Raf.

Rare in damp sandy soil of ditches, bogs, and marshes in Cumberland, Hoke, and Robeson counties of North Carolina. Extending northward into New England, southward into Florida and westward into Indiana and Mississippi. [*L. sessilifolius* Gray, *L. pubens* Britt.]

## 2. SCUTELLARIA: Skullcap

1. *Scutellaria lateriflora* L.

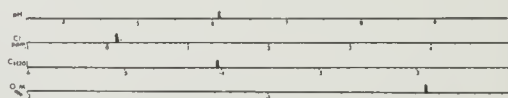
Frequent in low ground, swamps, marshes, and margins of streams and ponds throughout North Carolina. Extending throughout the United States.



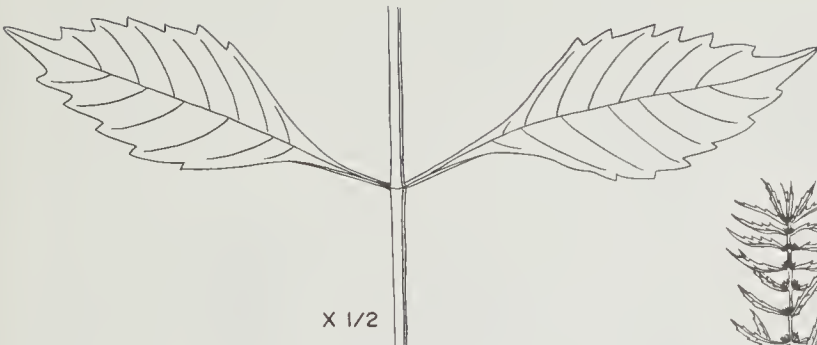
## 3. MACBRIDEA

1. *Macbridea caroliniana* (Walt.) Blake

Rare in low ground, bogs, and marshes in Columbus, Jones, and Sampson counties of North Carolina. Extending southward into Florida and Alabama. [*M. pulchra* Ell.]

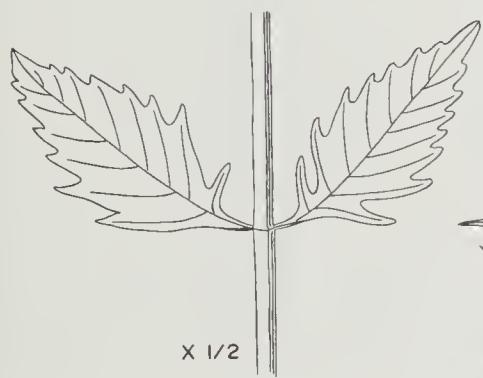


LYCOPUS



X 1/2

*L. virginicus*



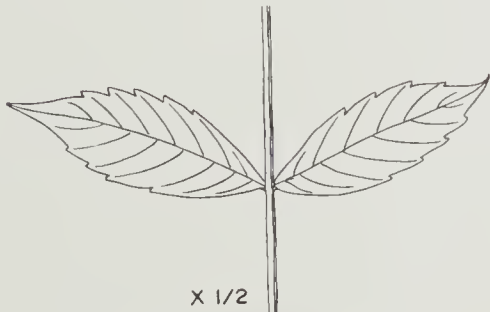
X 1/2

*L. europaeus*



X 1/2

*L. rubellus*



X 1/2

*L. amplexans*



X 1/4

*L. americanus*





*S. lateriflora*



*M. caroliniana*

#### 4. DRACOCEPHALUM: *Obedient Plant*

##### 1. *Dracocephalum purpureum* (Walt.) McClint.

Frequent in low ground, ditches, and marshes in the Coastal Plain of North Carolina. Extending northward into Virginia, southward into Florida and westward into Texas thence in the interior into Arkansas. [*D. denticulatum* Ait., *Physostegia denticulata* (Ait.) Britt., *P. obovata* (Ell.) Godfrey]

#### 5. MENTHA: *Mint*

##### 1. *Mentha piperita* L., *Peppermint*

Frequent in low ground, ditches, and stream margins in scattered locations throughout North Carolina. An introduction of European origin that is widely cultivated, and escaped, throughout the United States.

#### 6. STACHYS: *Hedge-nettle*

- a. Leaves ovate-oblong to elliptic, acuminate, with petioles 5-25 mm long, usually pubescent.....1. *S. latidens*
- a. Leaves narrowly linear to narrowly oblong, sessile or with petioles on lower leaves up to 10 mm long but becoming reduced on upper leaves, glabrous.....2. *S. hyssopifolia*

##### 1. *Stachys latidens* Small

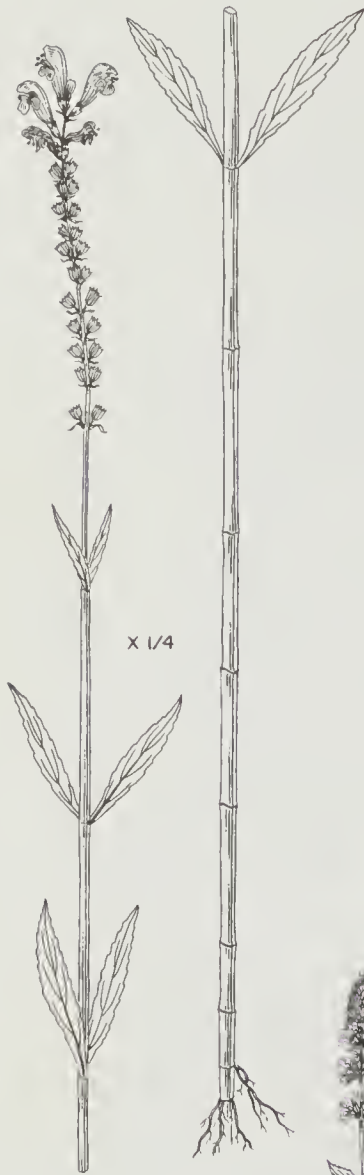
Frequent in low ground, stream margins, and marshes in the Blue Ridge and adjacent Piedmont of North Carolina. Extending northward into West Virginia, southward into Georgia and westward into Tennessee.

##### 2. *Stachys hyssopifolia* Michx.

Infrequent in low ground, sandy shores, and marshes in scattered localities in the Piedmont and Coastal Plain provinces of North Carolina. Extending northward into Massachusetts, southward into Georgia and westward into West Virginia and Kentucky; Michigan and Indiana. [*S. ambigua* (Gray) Britt., *S. aspera* Michx.]

#### --SCROPHULARIACEAE--

- a. Plant minute, with tufted linear leaves and pedicels bearing solitary flowers arising from a slender rhizome.....1. *Limosella*
- a. Plant with erect or horizontal leafy stem; leaves opposite.
  - b. Stem creeping or floating, sometimes with the younger stem tips ascending.
    - c. Plant forming a mat on mud or floating on water; corolla 1.5 mm or less long, zygomorphic, white; sepals 4.....2. *Micranthemum*
    - c. Plant creeping but with ascending stem tips; corolla 3 mm or more long, weakly zygomorphic to regular, white to blue; sepals 5.....3. *Bacopa*
  - b. Stem erect, often with some branches decumbent.
    - d. Corolla 2.4-4 cm long.....4. *Mimulus*
    - d. Corolla 1.5 cm or less in length.
      - e. Fertile stamens 4.
        - f. Leaves elliptic to oblanceolate; stamens equal; plant of freshwater areas.....5. *Mecardonia*



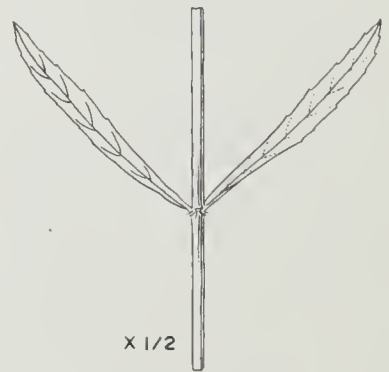
*D. purpureum*



*S. latidens*



*M. piperita*



*S. hyssopifolia*

- f. Leaves linear; stamens 2 long and 2 short; plant of salt marshes.....6. *Agalinis*
- e. Fertile stamens 2, often also with 2 sterile filaments.
- g. Sepals 4; capsule obcordate.....7. *Veronica*
- g. Sepals 5; capsule globose, ovoid or ellipsoid.
- h. Sterile stamens 2, their filaments conspicuous, partially adnate to the yellow ridges in the corolla throat; peduncle without bracteoles below the calyx; capsule ellipsoid to ovate....8. *Lindernia*
- h. Sterile stamens absent or minute, not conspicuous; bracteoles at base of calyx usually present; capsule globose to ovoid.....9. *Gratiola*

### 1. LIMOSELLA: *Mudwort*

#### 1. *Limosella subulata* Ives

Very rare on intertidal mud flats and in brackish marshes of Currituck County, North Carolina. Extending northward into Maine. [*L. aquatica* var. *tenuiflora* of some Am. authors, not Schub. and Mart.]

### 2. MICRANTHEMUM

#### 1. *Micranthemum umbrosum* (J.F. Gmel.) Blake

Frequent as a mat in sandy low woods and shores of streams and pools chiefly in the Coastal Plain of North Carolina. Extending northward into Virginia and southward, along the Atlantic and Gulf coasts, into Florida and Texas. [*Globifera umbrosa* (Walt.) J.F. Gmel.]



### 3. BACOPA: *Water-hyssop*

- a. Leaves cuneate to a narrow base; leaf blade with 1 vein...1. *B. monnieri*
- a. Leaves rounded to a broad base; leaf blade with 3 or more veins.
- b. Plant aromatic; bristles well developed around ovary; corolla blue; outer sepals not distinctly reticulate-veined.....2. *B. caroliniana*
- b. Plant not aromatic; bristles around ovary poorly developed; corolla white; outer sepals strongly cordate and distinctly reticulate-veined.....3. *B. cyclophylla*

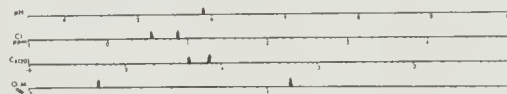
#### 1. *Bacopa monnieri* (L.) Pennell

Locally abundant in swales and wet sandy shores in the outer Coastal Plain of North Carolina. Extending, in coastal areas, from Virginia into Texas. [*Bramia monnieri* (L.) Pennell]



#### 2. *Bacopa caroliniana* (Walt.) Robins.

Infrequent in marshes and sandy stream and pond margins in Brunswick, New Hanover, and Pender counties of North Carolina. Extending, in the





Coastal Plain, from Virginia into Texas. [*Hydrotrida caroliniana* (Walt.) Small]

3. *Bacopa cyclophylla* Fern.

Rare in muddy and often tidal shores in Chowan, New Hanover, and Pender counties of North Carolina. Extending northward into Maryland and southward into Florida. [*Herpestis rotundifolia* Gaert. f.]



4. MIMULUS: *Monkey-flower*

- a. Leaves sessile; stem wingless or, at most, barely winged.....1. *M. ringens*
- a. Leaves petiolate; stem distinctly winged.....2. *M. alatus*

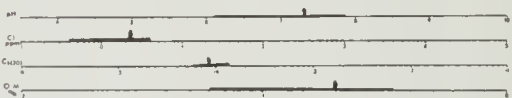
1. *Mimulus ringens* L.

Frequent in low ground, marshes, and stream banks chiefly in the Blue Ridge and Piedmont provinces of North Carolina. Extending throughout the eastern half of the United States except for Florida.



2. *Mimulus alatus* Ait.

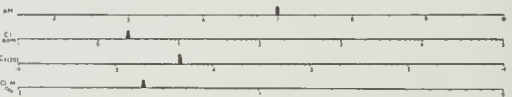
Frequent in low ground, marshes, and stream banks in the Piedmont and Coastal Plain provinces of North Carolina. Extending northward into Connecticut, southward into Florida and westward into Michigan, Illinois, Iowa, Nebraska, and Texas; scattered locations in the western states.



5. MECARDONIA

1. *Mecardonia acuminata* (Walt.) Small

Frequent in low ground, ditches, marshes, and pond margins in the Piedmont and Coastal Plain provinces of North Carolina. Extending northward into Maryland, southward into Florida and westward into Tennessee, Missouri, and eastern Texas. [*Bacopa acuminata* (Walt.) Robins.]



6. AGALINIS: *Gerardia*

1. *Agalinis maritima* (Raf.) Raf.

Rare in salt marshes in Brunswick, Carteret, Dare, and Hyde counties of North Carolina. Extending, along the Atlantic and Gulf coasts, from Maine into Texas. [*Gerardia maritima* Raf.]

7. VERONICA: *Speedwell*

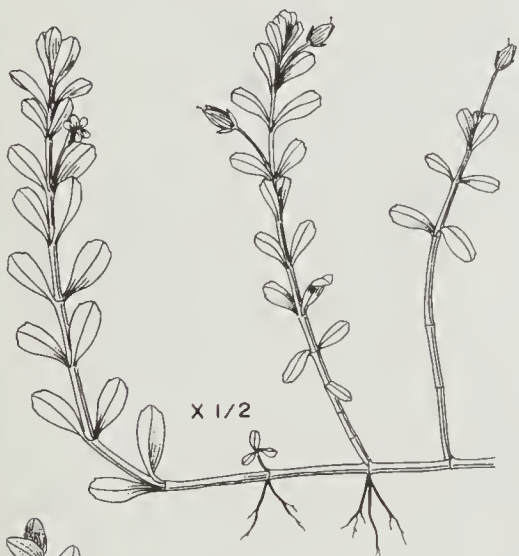
- a. Upper leaves sessile; pedicel pubescent.....1. *V. anagallis-aquatica*
- a. Upper leaves petiolate; pedicel glabrous.....2. *V. americana*



LIMOSELLA   MICRANTHEMUM   BACOPA   MIMULUS



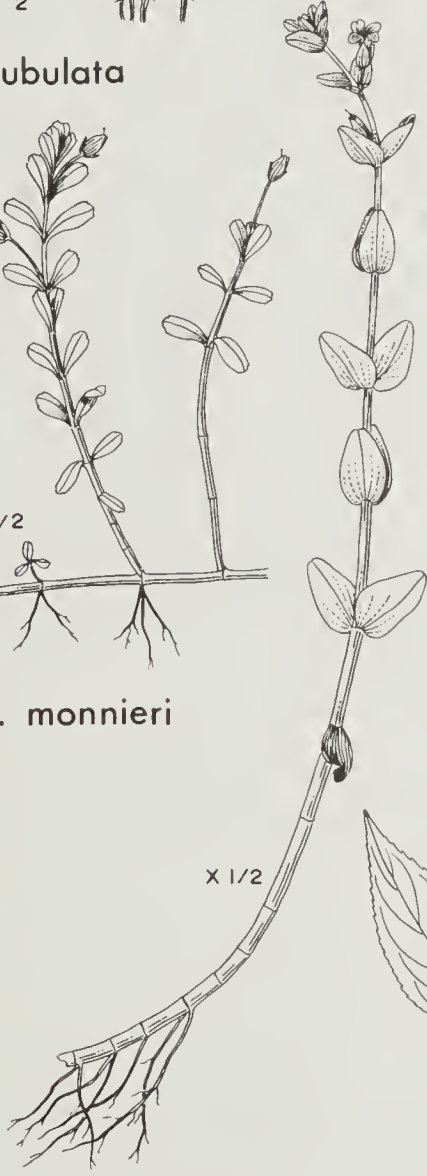
*L. subulata*



*B. monnieri*



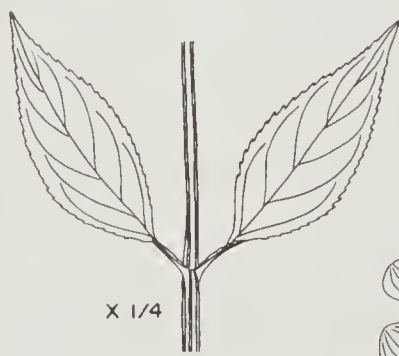
*B. cyclophylla*



*B. caroliniana*



*Mim. ringens*



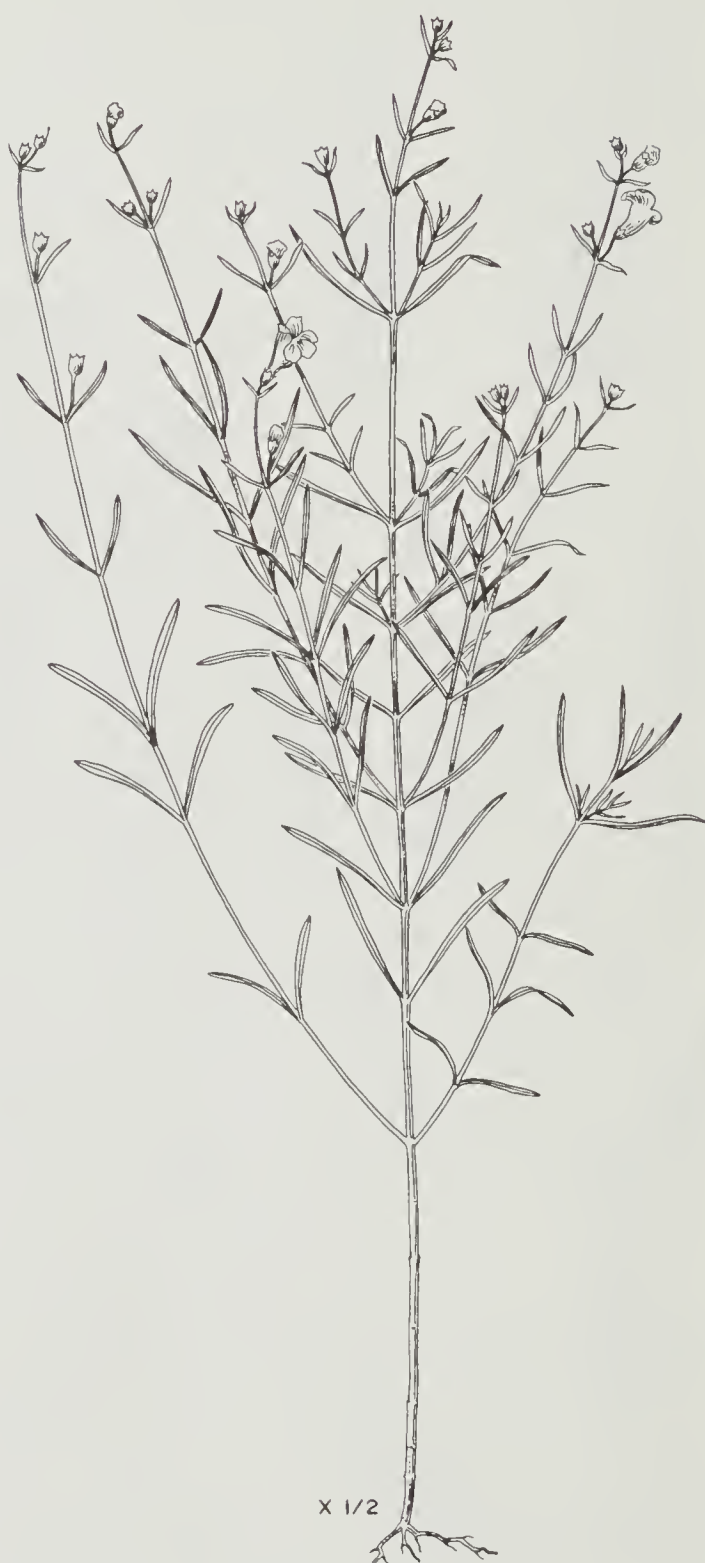
*Mim. alatus*



*Mic. umbrosum*



*M. acuminata*



*A. maritima*

1. *Veronica anagallis-aquatica* L.

Rare in low ground, marshes, and along stream margins in the Blue Ridge Province of North Carolina. Widely distributed in the United States except in the southeastern states from Louisiana to South Carolina. [*V. glandifera* Pennell]

2. *Veronica americana* (Raf.) Schw. & Benth.

Rare in low ground, springs, marshes, swamps, and along stream banks in the Blue Ridge Province of North Carolina. Widely distributed in the United States except in the south from Texas to South Carolina.

8. LINDERNIA: False Pimpernel

- a. Leaves minutely glandular-punctate.....1. *L. saxicola*
- a. Leaves not glandular-punctate.....2. *L. dubia*
  - b. Pedicels barely equaling or shorter than subtending leaves; sepals equaling or longer than the capsule....a. var. *dubia*
  - b. Pedicels much longer than the subtending leaves; sepals usually shorter than mature capsule.....b. var. *anagallidea*

1. *Lindernia saxicola* M. A. Curtis

Very rare on rocks in the Hiwassee River in Cherokee County, North Carolina. Extending southward into northern Georgia.

2. *Lindernia dubia* (L.) Pennell

The following two taxa exhibit considerable intergradation of morphological features and would make excellent subjects for experimental analyses.

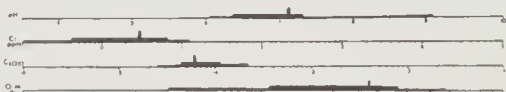
a. var. *dubia*

Common in low ground, ditches, marshes, and margins of streams and ponds throughout North Carolina. Extending northward into New Hampshire, southward into Florida, and westward into North Dakota and Texas; Pacific coastal states. [*Ilysanthes dubia* (L.) Barnh.]



b. var. *anagallidea* (Michx.) Cooperrider

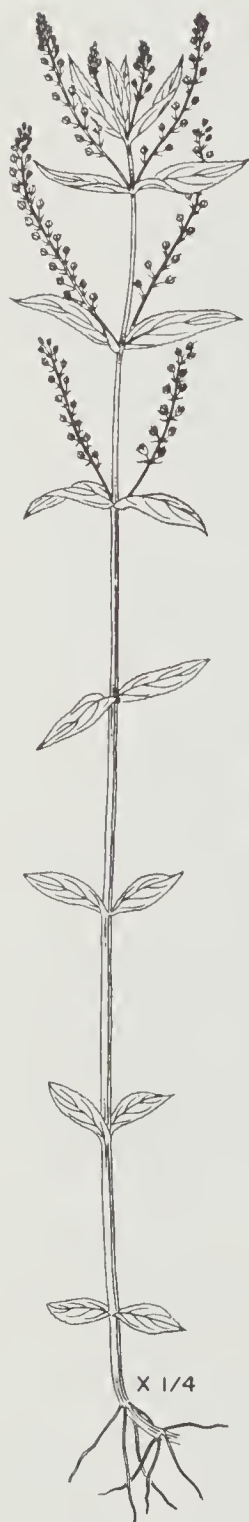
Frequent in low ground, ditches, marshes, and margins of streams and ponds chiefly in the Piedmont and Coastal Plain provinces of North Carolina. Extending northward into New Hampshire, southward into Florida and westward into Ohio, Indiana, Wisconsin, Minnesota, Washington, California, and Texas. [*L. anagallidea* (Michx.) Pennell, *Ilysanthes inequalis* (Walt.) Pennell]



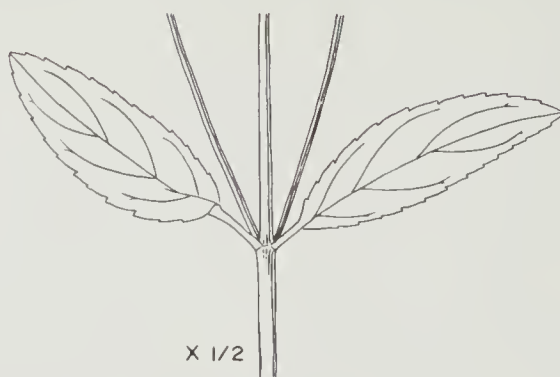
9. GRATIOLA: Hedge Hyssop

- a. Flowers essentially sessile.....1. *G. pilosa*
- a. Flowers distinctly pedicellate.
  - b. Leaves gradually tapering to base, broadest near or above the middle, linear, elliptic, oblanceolate or obovate.
    - c. Pedicels filiform, 10 mm or more long.....2. *G. neglecta*
    - c. Pedicels stout, usually less than 5 mm long.....3. *G. virginiana*
  - b. Leaves broad near the base, linear to ovate.
    - d. Sepals, bracts, and leaves glandular-punctate; leaves entire or, at most, obscurely toothed; corolla yellow throughout.....4. *G. aurea*

VERONICA      LINDERNIA      GRATIOLA



*V. anagallis-aquatica*



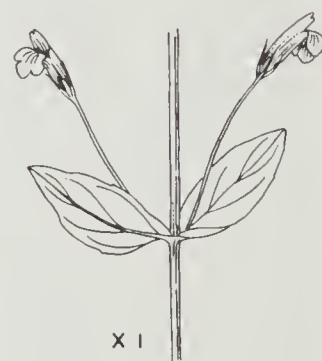
*V. americana*



*L. saxicola*



var. *dubia*

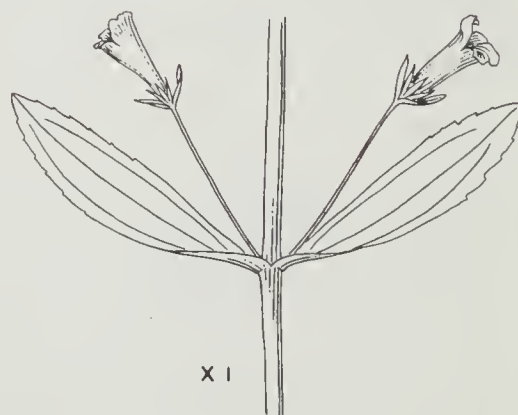


var. *anagallidea*

*L. dubia*



*G. pilosa*



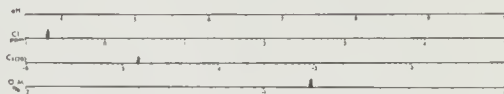
*G. neglecta*



- d. Sepals, bracts, and leaves not obviously glandular-punctate; leaves toothed; corolla tube yellow with white to lavender lobes.
- e. Leaves linear-lanceolate to subulate, usually with 1-3 glandular teeth on each margin; 1-sometimes faintly 3-nerved.....5. *G. ramosa*
- e. Leaves ovate, with several teeth on each margin, 3-5-nerved.....6. *G. viscidula*

1. *Gratiola pilosa* Michx.

Frequent in low ground and occasionally in marshes chiefly in the Coastal Plain and adjacent Piedmont of North Carolina. Extending northward into Maryland, southward into Florida and westward, chiefly in the Coastal Plain, into Texas thence northward into Arkansas, Tennessee, and Kentucky. [*Tragiola pilosa* (Michx.) Small]



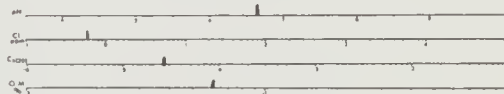
2. *Gratiola neglecta* Torr.

Infrequent in low ground and muddy places throughout North Carolina. Extending throughout the United States except Florida.



3. *Gratiola virginiana* L.

Common in low ground, ditches, stream banks, and pond margins throughout the Piedmont and Coastal Plain provinces of North Carolina. Extending northward into Maryland, southward into Florida and westward into Iowa, Kansas, and Texas.



4. *Gratiola aurea* Pursh

Rare in ditches and sandy shores in Pender and Sampson counties of North Carolina. Extending, along the Atlantic coastal states, northward into New England, southward into Florida and westward, along the northern states, into North Dakota.

5. *Gratiola ramosa* Walt.

Rare in low ground, ditches, and pond margins in Bladen, Brunswick, and Hoke counties of North Carolina. Extending, along the Atlantic and Gulf coasts, from Maryland into Florida, Oklahoma, and Texas.

6. *Gratiola viscidula* Pennell

Frequent in low ground, ditches, marshes, pond margins, and stream banks in scattered localities throughout North Carolina. Extending northward into Maryland, southward into Georgia and westward into Ohio, Kentucky, and Tennessee.



--LENTIBULARIACEAE--

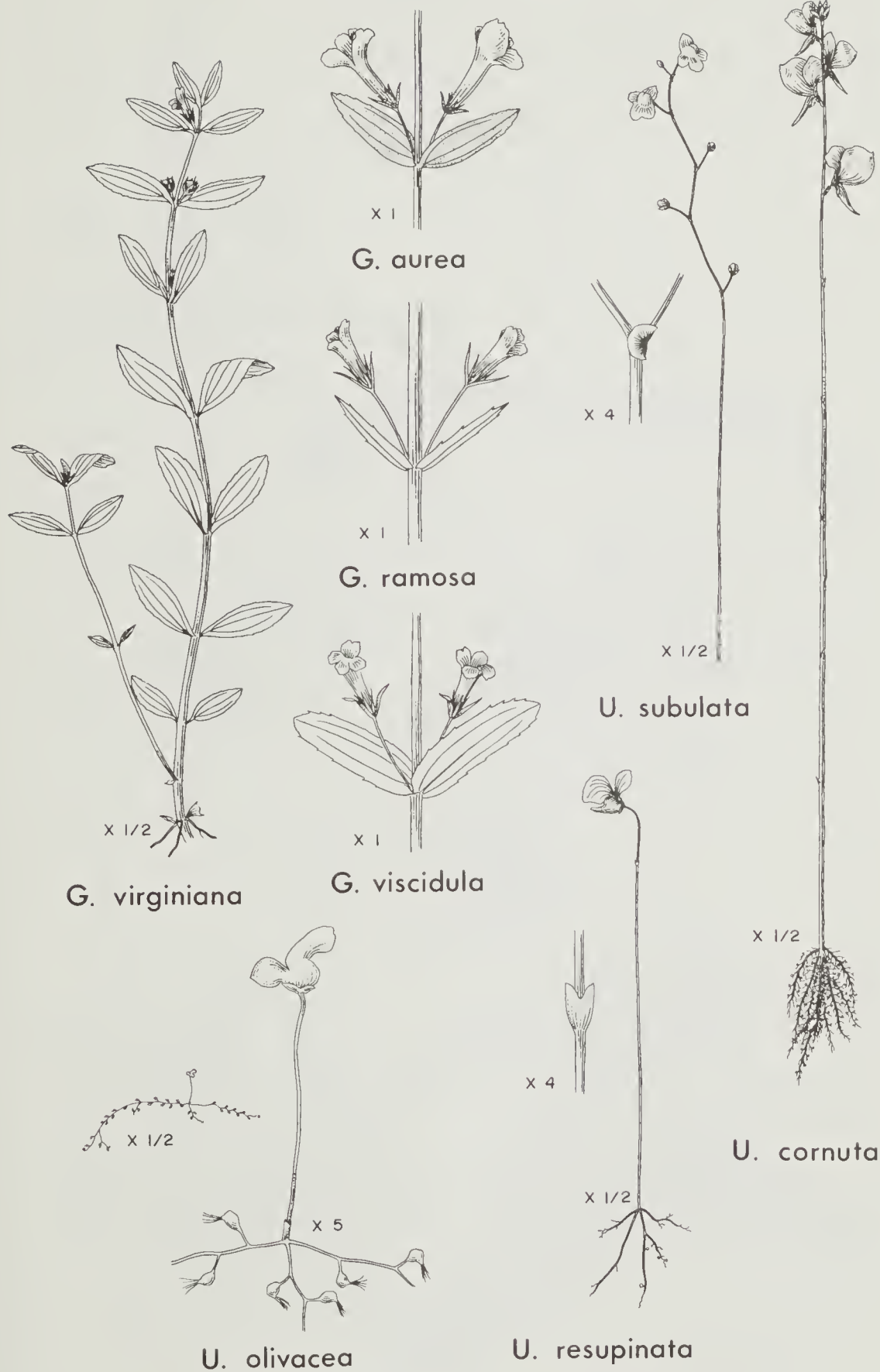
1. UTRICULARIA: Bladderwort

- a. Stems (except for the scape) subterranean, with very

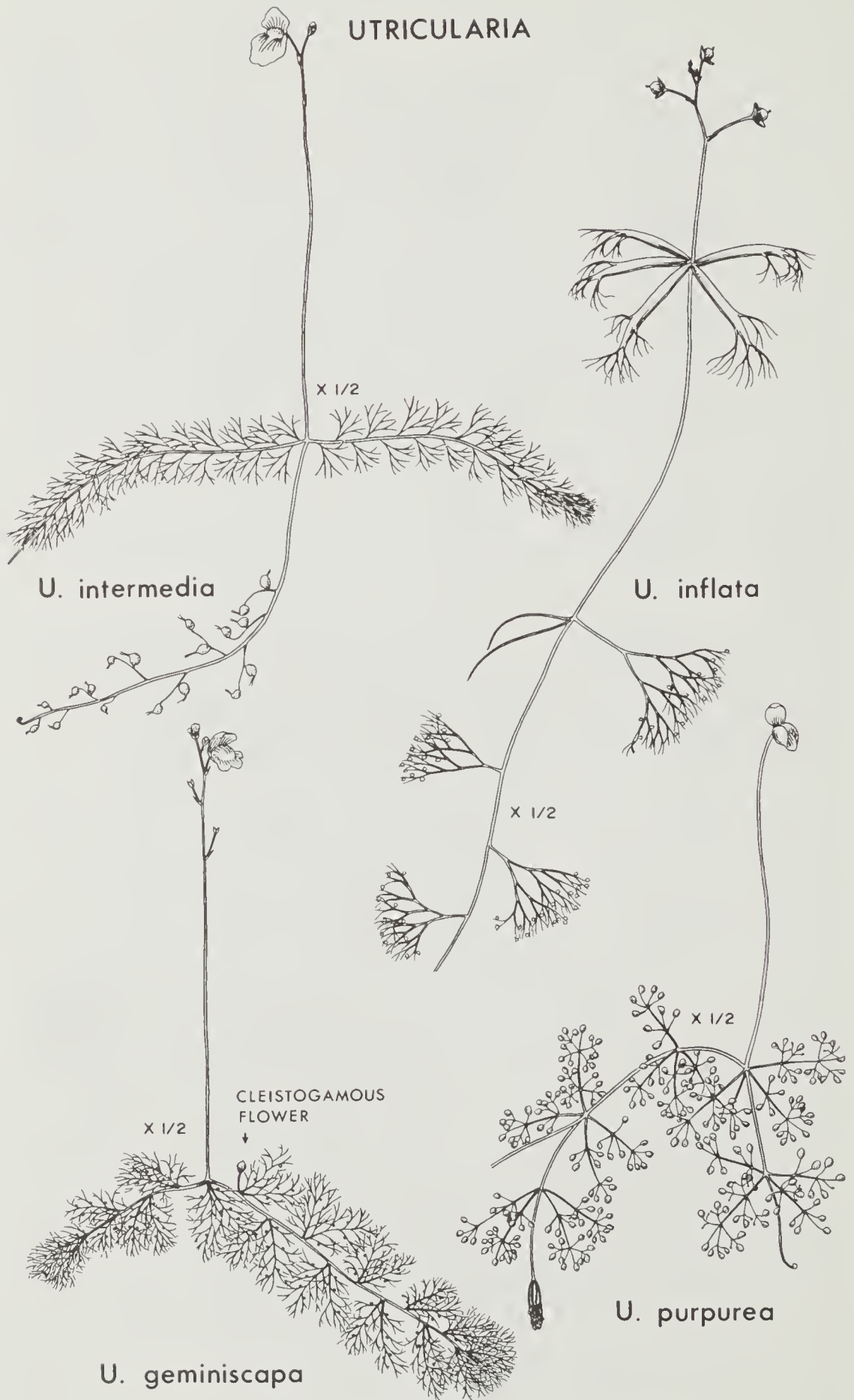


- slender leaves and minute bladders imbedded in moist peat, sand or muck.
- b. Bract at base of pedicel peltate.....1. *U. subulata*
  - b. Bract at base of pedicel basally attached.
    - c. Corola purple; bracts on the scape fused into a truncate or notched conical cup.....2. *U. resupinata*
    - c. Corolla yellow; bracts not fused into a cup.....3. *U. cornuta*
  - a. Stems floating or submersed (if stranded on mud, the branches and leaves creeping on the surface, not imbedded in soil).
    - d. Corolla white; leaves simple, each bearing one bladder; flower solitary, minute, borne on an erect pedicel less than 1 cm tall; scape absent.....4. *U. olivacea*
    - d. Corolla yellow or purple; leaves dissected into elongate segments at least some of which bear bladders; flowers usually more than one on an erect scape which is more than 1 cm long.
      - e. Vegetative branches of two types, some bearing bladders others bearing only divided (usually thrice) leaves, with flat, finely serrate divisions.....5. *U. intermedia*
      - e. Vegetative branches all bearing similar leaves.
        - f. Petioles of upper leaves inflated, floating near the water surface.....6. *U. inflata*
        - f. Petioles not inflated.
          - g. Flowers purple; all leaves whorled.....7. *U. purpurea*
          - g. Flowers yellow; leaves alternate.
            - h. Plant bearing flowers of two types, petaliferous yellow flowers and cleistogamous flowers without petals, the latter on short pedicels..8. *U. geminiscapa*
            - h. Plant bearing uniform flowers, all with yellow petals.
              - i. Stem 0.5 mm or more in diameter; flowers 6-many per scape, the pedicels recurving in fruit; leaf 3-7-times divided.....9. *U. vulgaris*
              - i. Stem less than 0.5 mm in diameter; flowers 1-6 per scape, the pedicels erect in fruit; leaf divided no more than 4 times.
                - j. Branches not radiating from base of scape; leaves usually once but no more than twice forked; lower corolla lip 5-6 mm long; spur blunt, less than 5 mm long.....10. *U. gibba*
                - j. Branches radiating from the base of the scape; leaves, when fully developed, forked twice or more; lower corolla lip 8-10 mm long; spur more than 5 mm long.
                  - k. Spur conic at base, cylindric above, equal to or longer than lower corolla tip; leaves of two types, those bladder-bearing usually divided twice, those not bladder-bearing divided thrice.....11. *U. fibrosa*
                  - k. Spur conic from base to tip, shorter than lower corolla lip; leaves all alike and bearing bladders, thrice divided...12. *U. biflora*

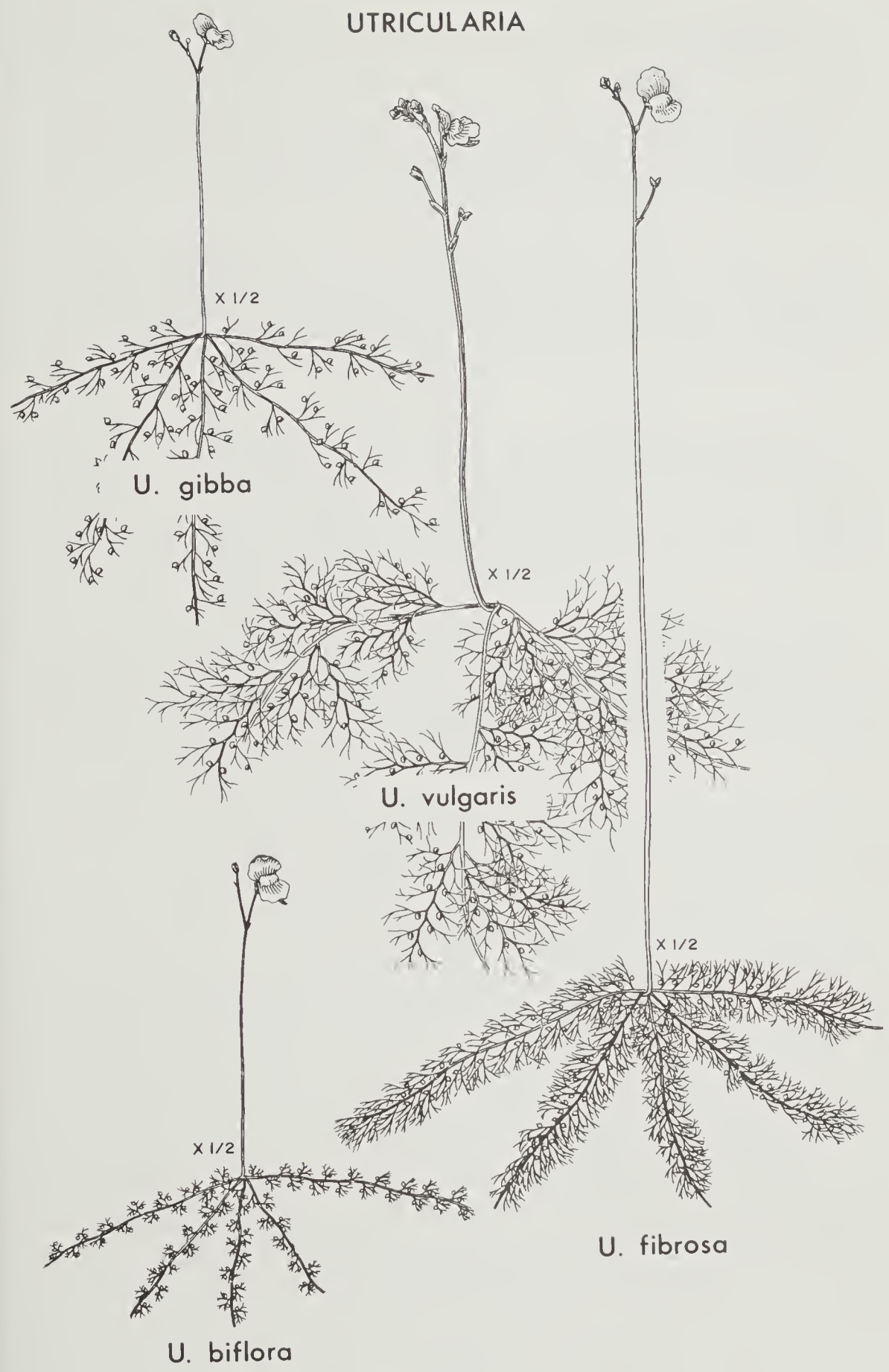
# GRATIOLA UTRICULARIA



UTRICULARIA



UTRICULARIA





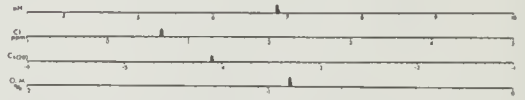
1. *Utricularia subulata* L.

Moist sandy soil of bogs, ditches, and pond margins chiefly in the Coastal Plain of North Carolina. Extending, in the coastal states, from New England into Florida and Texas and inland into Arkansas and Tennessee. [*U. cleistogama* (Gray) Britt., *Setiscapella cleistogama* (Gray) Barnh., *S. subulata* (L.) Barnh.]



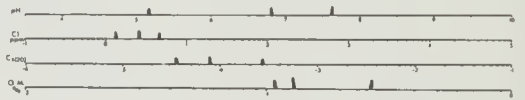
2. *Utricularia resupinata* B. D. Greene

Very rare in moist sand of lake shores in Washington County, North Carolina. Extending northward into New England and southward into Florida; states surrounding Lake Michigan. [*Lecticula resupinata* (B. D. Greene) Barnh.]



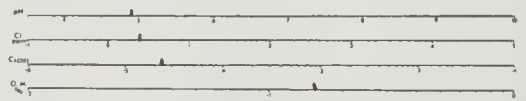
3. *Utricularia cornuta* Michx.

Locally abundant in moist sandy soil of ditches, bogs, and depressions chiefly in the Coastal Plain of North Carolina. Extending northward into Maine, southward into Florida and westward into Minnesota and Texas. [Includes *U. juncea* Vahl, *Stomosis cornuta* (Michx.) Raf.]



4. *Utricularia olivacea* Wright ex Griseb.

Rare in sandy coastal ponds in Brunswick and Carteret counties of North Carolina. Extending northward into New Jersey and southward into Florida. [*Biovularia olivacea* (Wright) Kam., *U. minima* Warming]



5. *Utricularia intermedia* Hayne

Reported in a bog in Watauga County, North Carolina. The North Carolina location represents the southern-most extension of a range which otherwise is from Delaware, Pennsylvania, Ohio, Indiana, Illinois, Iowa, and California northward. Specimen not seen.

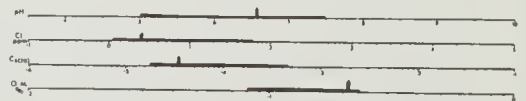
6. *Utricularia inflata* Walt.

Frequent in ponds and ditches throughout the Coastal Plain of North Carolina. Extending, along the Atlantic and Gulf coasts, northward into Maine and southward into Florida and Texas; Tennessee and Indiana. [Includes *U. radiata* Small]



7. *Utricularia purpurea* Walt.

Locally abundant in pools and sluggish streams in the Sand Hills and outer Coastal Plain of North Carolina. Extending, along the Atlantic and Gulf coasts, northward into Maine and southward into Florida and Texas; Great Lakes states. [*Vesiculina purpurea* (Walt.) Raf.]

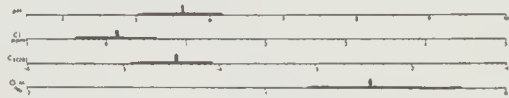




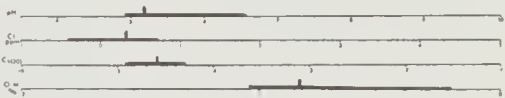
8. *Utricularia geminiscapa* Benji.  
Very rare in ponds in Beaufort County, North Carolina. Extending northward into Maine and westward into Wisconsin. [*U. clandestina* Nutt.]

9. *Utricularia vulgaris* L.  
Locally abundant in ponds and lakes chiefly in the northeastern portion of the Coastal Plain of North Carolina. Extending throughout the United States but more abundant northward. [*U. macrorrhiza* Le Conte]

10. *Utricularia gibba* L.  
Locally abundant in pools, springs, and bogs chiefly in the Coastal Plain of North Carolina. Extending throughout the eastern half of the United States; Pacific Coastal states.



11. *Utricularia fibrosa* Walt.  
Locally abundant in ponds and ditches in the Coastal Plain of North Carolina. Extending, along the Atlantic and Gulf coasts, from Massachusetts to Florida and Texas thence in the interior into Arkansas and Oklahoma.



12. *Utricularia biflora* Lam.  
Frequent in ponds and ditches chiefly in the southern two-thirds of the Coastal Plain of North Carolina. Extending, along the Atlantic and Gulf coasts, northward into New England and southward into Florida and Texas; West Virginia, Arkansas, Oklahoma, and New Mexico. [*U. pumila* Walt.]



--ACANTHACEAE--

1. JUSTICIA: *Water-willow*

- a. Seeds coarsely pebbled, the margins not thickened; leaves oblong-lanceolate to lance-linear; veins indistinct, strongly curved distally and anastomosing extensively.....1. *J. americana*
- a. Seeds nearly smooth, the margins thickened; leaves rhombic-oblong to elliptic-ovate; veins distinct, slightly curved distally and with few anastomoses.....2. *J. ovata*

*Justicia americana* and *J. ovata* appear distinct in habitat and morphology except in the Coastal Plain where the ranges overlap. In this area numerous morphologically intermediate plants exist as noted by Beal and Brown (1976). Experimental studies are needed to clarify the situation.

1. *Justicia americana* (L.) Vahl  
Common in river beds and, occasionally, pond margins chiefly in the Piedmont and northern portion of the Coastal Plain in North Carolina. Extending northward into Vermont, southward into Georgia and westward into Wisconsin, Missouri, Kansas, Oklahoma, and Texas. [*Dianthera americana* L.]



# JUSTICIA



*J. ovata*



*J. americana*

2. *Justicia ovata* (Walt.) Lind.

Frequent in rivers, swamps, and marshes in the Coastal Plain of North Carolina. Extending northward into Virginia and southward into Florida. [*J. humilis* Michx.]



--PLANTAGINACEAE--

1. PLANTAGO: *Plantain*

1. *Plantago cordata* Lam.

Rare in slate-bottom streams in Davidson and Stanley counties of North Carolina. Extending northward into New York, southward into Georgia and westward into Minnesota, Missouri, and Louisiana.

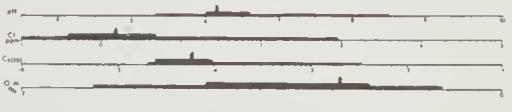
--RUBIACEAE--

- a. Plant a shrub.....1. *Cephalanthus*
- a. Plant herbaceous.....2. *Galium*

1. CEPHALANTHUS: *Button Bush*

1. *Cephalanthus occidentalis* L.

Abundant in low ground, marshes, ponds, and along streams throughout North Carolina except in the extreme west. Extending throughout the eastern half of the United States; western states.



2. GALIUM: *Bedstraw*

1. *Galium tinctorium* L.

Common in low ground, ditches, marshes, and margins of ponds, lakes, and streams throughout North Carolina. Extending northward into New England, southward into Georgia and westward into Washington, New Mexico, and Texas. [*G. claytoni*, Michx., *G. obtusum* var. *floridanum* (Wieg.) Fern., and includes *G. obtusum* Bigelow]



Several species of *Galium* grow in low ground. Thus, if the above species is not clearly indicated a more comprehensive manual should be consulted.

*Galium obtusum* is included within *G. tinctorium* since many specimens exhibit flowers with both 3-and 4-lobed corollas. Moreover, a superficial examination indicates that the morphological features by which these two taxa are supposedly distinguishable do not seem to be effective in resolving these two taxa among the plants in North Carolina. A critical examination of specimens is needed to clarify this point.

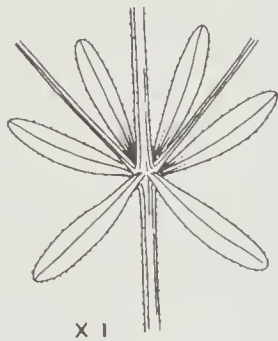
# PLANTAGO



*P. cordata*

CEPHALANTHUS

GALIUM



G. tinctorium



C. occidentalis

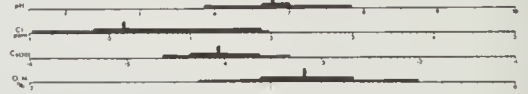


1. LOBELIA: *Lobelia*

- a. Corolla red.....1. *L. cardinalis*
- a. Corolla blue, violet or whitish.
  - b. Stem leaves all 4 mm or less wide; corolla tube less than 8 mm long.....2. *L. nuttallii*
  - b. Stem leaves, at least some of them, more than 5 mm wide, mostly more than 10 mm wide; corolla tube 8 mm or more long.
    - c. Sepal lobes with well developed, reflexed, and broadly rounded auricles, ciliate along the margins.....3. *L. siphilitica*
    - c. Sepal lobes without well developed auricles, not ciliate along the margins.
      - d. Filament tube 7 mm or less long; mountain species..4. *L. amoena*
      - d. Filament tube 8 mm or more in length; plant of the Coastal Plain and occasionally in the Piedmont...5. *L. elongata*

1. *Lobelia cardinalis* L., Cardinal Flower

Common in low ground, marshes, stream margins, and around ponds throughout North Carolina. Extending throughout the eastern half of the United States.



2. *Lobelia nuttallii* R. & S.

Frequent in swales, bogs, marshes, and pond margins throughout North Carolina except in the northwest. Extending northward into Long Island, southward into northwestern Florida and westward into eastern Pennsylvania, Kentucky, Tennessee, and Alabama.



3. *Lobelia siphilitica* L., Great Lobelia

Frequent in low ground, swamps, and along stream banks in the Blue Ridge Province of North Carolina. Extending throughout the eastern half of the United States.

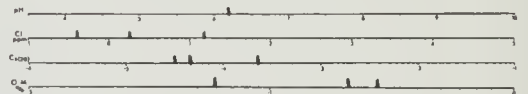
4. *Lobelia amoena* Michx.

Frequent in marshes, swamps, and stream banks in the southern portion of the Blue Ridge Province of North Carolina. Extending northward into Virginia, southward into Florida and thence westward into Mississippi.



5. *Lobelia elongata* Small

Frequent in fresh to brackish marshes and swamps chiefly in the Coastal Plain and less frequently in the Piedmont of North Carolina. Extending northward into Maryland and southward into Florida. [Includes *L. glandulosa* Walt.]



# LOBELIA



*L. cardinalis*



*L. siphilitica*



*L. elongata*



*L. nuttallii*



*L. amoena*

- a. Leaves alternate.
  - b. Plant a shrub of brackish marshes.....1. *Baccharis*
  - b. Plant herbaceous (of brackish or freshwater areas).
    - c. Flowering heads overlapping in elongated and curving panicles, the panicle branches tending to be ascending on the convex side of the main axis; plant of brackish marshes.....2. *Solidago*
    - c. Flowering heads in an open or compacted inflorescence but not arranged in elongated, curving panicles; plant of brackish or freshwater areas).
      - d. Nutlet with a pappus consisting of two awns, 2-winged, glabrous.....3. *Boltonia*
      - d. Nutlet with a pappus consisting of capillary bristles, not winged, often pubescent.
        - e. The nutlet with 5 distinct ribs, cylindric; ray flowers absent.....4. *Pluchea*
        - e. The nutlet not 5-ribbed, tapering from base to apex, ellipsoid or oblanceolate; ray flowers present.....5. *Aster*
  - a. Leaves opposite or whorled.
    - f. Plant a shrub of brackish marshes.
      - g. Leaves covered with a grayish-white pubescence, fleshy, obovate to oblanceolate, entire or with a few spinulose serrations, apex sharply mucronate; heads erect, bur-like in fruit.....6. *Borrichia*
      - g. Leaves green, lanceolate to elliptic, serrate, apex acute but not mucronate; heads pendent, not bur-like.....7. *Iva*
    - f. Plant herbaceous, mostly of freshwater areas.
      - h. Stem climbing as a vine with ovate to ovate-triangular, entire, cordate leaves.....8. *Mikania*
      - h. Stem erect, not climbing.
        - i. Leaves whorled, never compound.....9. *Sclerolepis*
        - i. Leaves opposite, simple or compound.
          - j. Bracts in two series; nutlet awned.....10. *Bidens*
          - j. Bracts in one series; nutlet with a very short crown, not awned.....11. *Eclipta*

## 1. BACCHARIS

### 1. *Baccharis angustifolia* Michx., False-willow

Locally abundant in brackish swamps and marshes in the outer Coastal Plain of North Carolina. Extending southward, along the Atlantic and Gulf coasts, into Florida and Texas.

## 2. SOLIDAGO: Goldenrod

### 1. *Solidago sempervirens* L.

Frequent in brackish and salt marshes in the outer Coastal Plain of North Carolina. Extending throughout the Atlantic and Gulf coastal areas of the United States. [*S. mexicana* L.]

### 3. BOLTONIA: *Boltonia*

#### 1. *Boltonia asteroides* (L.) L'Her.

Infrequent in low ground, ditches, and marshes in the southeastern and northwestern portions of the Coastal Plain of North Carolina. Extending northward into New Jersey and southward, along the Atlantic and Gulf states, into Florida and Texas; Oklahoma.

### 4. PLUCHEA: *Marsh-fleabane, Stinkweed*

- a. Corolla pink; at least the lower leaves petiolate, without clasping bases.....1. *P. purpurascens*
- a. Corolla creamy white; leaves sessile, with clasping bases.....2. *P. foetida*

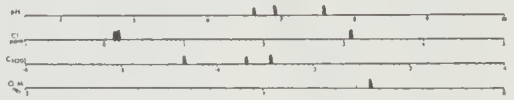
#### 1. *Pluchea purpurascens* (Swartz) DC., *Camphorweed*

Frequent in brackish marshes in the outer Coastal Plain of North Carolina. Extending, along the Atlantic, Gulf, and Pacific coasts, from Massachusetts into Florida, Texas, and California; local inland in Michigan and Kansas. [*P. camphorata* (L.) DC.]



#### 2. *Pluchea foetida* (L.) DC.

Common in low ground, ditches, marshes, and pond margins throughout the Coastal Plain of North Carolina. Extending northward into New Jersey, southward into Florida and westward into southeastern Missouri and Texas.



### 5. ASTER: *Aster*

- a. Leaves no more than 10 mm wide (usually less than 7 mm), linear to narrowly elliptic or lanceolate.
- b. Base of leaf auriculate; in freshwater areas.....1. *A. novi-belgii*
- b. Base of leaf not auriculate; in brackish marshes.
- c. Mature heads mostly 10 mm or more wide; ligule of ray flowers more than 5 mm long.....2. *A. tenuifolius*
- c. Mature heads less than 10 mm wide; ligule of ray flowers less than 5 mm long.
- d. Inflorescence of many heads in a diffuse panicle; heads 7-9 mm long; ligule 1-3 mm long, becoming outwardly coiled, barely, if at all, exceeding the pappus.....3. *A. subulatus*
- d. Inflorescence of few-to-many heads in a racemose panicle with ascending branches; heads 5-6 mm long; ligule up to 4 mm long, exserted.....4. *A. racemosus*
- a. Leaves broader, the principal stem leaves more than 7 mm wide.
- e. Leaf base not auriculate.
- f. Blade lamina not extending to the junction with the stem, margin entire but ciliate; pappus consisting of an outer short series of bristles and an inner long series of capillary bristles.....5. *A. umbellatus*



BACCHARIS

SOLIDAGO

BOLTONIA



*S. sempervirens*

*Bo. asteroides*

*Ba. angustifolia*



PLUCHEA ASTER



*P. foetida*



*P. purpurascens*



*A. tenuifolius*



*A. novi-belgii*



*A. racemosus*



*A. subulatus*

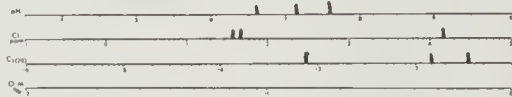
- f. Blade laminar-margined at junction with stem, margin entire, crenate or serrate; pappus of only long capillary bristles.
- g. Involucral bracts linear to oblanceolate, the tip acute; leaves crenate to entire.....1. *A. novi-belgii*
- g. Involucral bracts linear to lanceolate, the tip long-acuminate; leaves crenate to serrate.....6. *A. elliottii*
- e. Leaf base obviously auriculate.
- h. Involucral bracts with glandular hairs.....7. *A. novae-angliae*
- h. Involucral bracts pubescent or ciliate but not with glandular hairs.
- i. Bracts of the involucre oblanceolate, pubescent; stem densely pubescent.....8. *A. carolinianus*
- i. Bracts of the involucre linear to lanceolate, ciliate; stem glabrous to sparingly pubescent....9. *A. puniceus*

1. *Aster novi-belgii* L., New York Aster

Frequent in low ground and marshes throughout the Coastal Plain of North Carolina. Extending northward into New England and southward into Georgia and Alabama. [*A. elodes* T. & G.]

2. *Aster tenuifolius* L.

Frequent in brackish and salt marshes in the outer Coastal Plain of North Carolina. Extending, along the Atlantic and Gulf coasts, from New Hampshire into Florida and Texas.



3. *Aster subulatus* Michx.

Occasional in brackish marshes in the outer Coastal Plain of North Carolina. Extending northward into Maine and southward, along the Atlantic and Gulf coasts, into Florida and Texas; alkaline areas of Oklahoma, New Mexico, and Arizona.

4. *Aster racemosus* Ell.

Infrequent in low ground and brackish marshes in the outer Coastal Plain of North Carolina. Extending northward into Virginia and southward, along the Atlantic and Gulf coasts, into Florida and Texas.

5. *Aster umbellatus* Miller

Frequent in low ground, bogs, and marshes in the Blue Ridge Province of North Carolina. Extending northward into New England, southward into Florida and westward into Minnesota, Illinois, Tennessee, Oklahoma, and Texas. [*Doellingeria umbellata* (Miller) Nees, *D. humilis* (Willd.) Britton]

6. *Aster elliottii* T. & G.

Infrequent in low ground, swamps, bogs, and marshes in the outer Coastal Plain of North Carolina. Extending northward into Virginia and southward, along the Atlantic and Gulf coasts, into Florida and Louisiana.

7. *Aster novae-angliae* L., New England Aster

Infrequent in low ground, marshes, bogs, and shores of lakes and streams in the Blue Ridge Province of North Carolina. Extending northward into Maine, southward into Alabama and westward into South Dakota, Wyoming, Colorado, Kansas, Arkansas, and New Mexico.

# ASTER



*A. umbellatus*



*A. novae-angliae*



*A. puniceus*



*A. elliottii*



*A. carolinianus*

8. *Aster carolinianus* Walt.

Rare in low ground, swamps, and marshes in Bladen County, North Carolina. Extending southward into Florida.

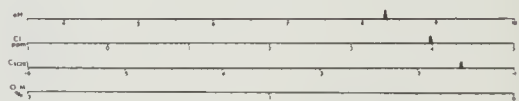
9. *Aster puniceus* L.

Frequent in low ground, marshes, swamps, and bogs chiefly in the Blue Ridge Province of North Carolina. Extending northward into Maine, southward into Georgia and westward into North Dakota, Iowa, Illinois, Tennessee, and Alabama.

6. BORRICHIA: Sea Ox-eye

1. *Borrichia frutescens* (L.) DC.

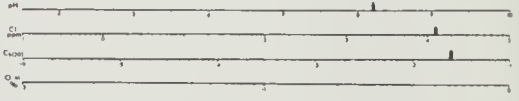
Common in brackish and salt marshes in the outer Coastal Plain of North Carolina. Extending, along the Atlantic and Gulf coasts, from Virginia to Texas.



7. IVA: Marsh-elder

1. *Iva frutescens* L.

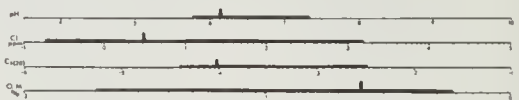
Common along brackish ditches and marshes in the outer Coastal Plain of North Carolina. Extending, along the Atlantic and Gulf coasts, from New Jersey to Texas.



8. MIKANIA: Climbing Hempweed

1. *Mikania scandens* (L.) Willd.

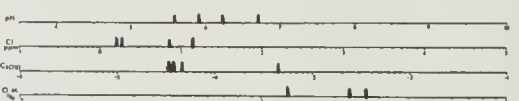
Common in low ground and along marshes, streams, and ditches throughout the Piedmont and Coastal Plain provinces of North Carolina. Extending northward into Maine, southward into Florida and westward into Michigan, Missouri, and Texas.



9. SCLEROLEPIS

1. *Sclerolepis uniflora* (Walt.) BSP.

Infrequent in streams, ditches, and ponds in the Coastal Plain Province of North Carolina. Extending northward into New Hampshire and southward into Florida and Alabama.



10. BIDENS: Bur-marigold, Beggar Ticks

- a. Blades of leaves never deeply lobed or divided, at most with two small lateral lobes toward the base.
- b. Leaves petiolate; ray flowers never produced.....1. *B. tripartita*
- b. Leaves sessile; ray flowers usually produced.
- c. Nutlet curved, with pale corky wing-like margins, keeled; marginal awns 2-2.8 mm long; chaff yellow-tipped; ray flowers, if present, no more than 1.7 cm long.....2. *B. cernua*



BORRICHIA IVA



*B. frutescens*

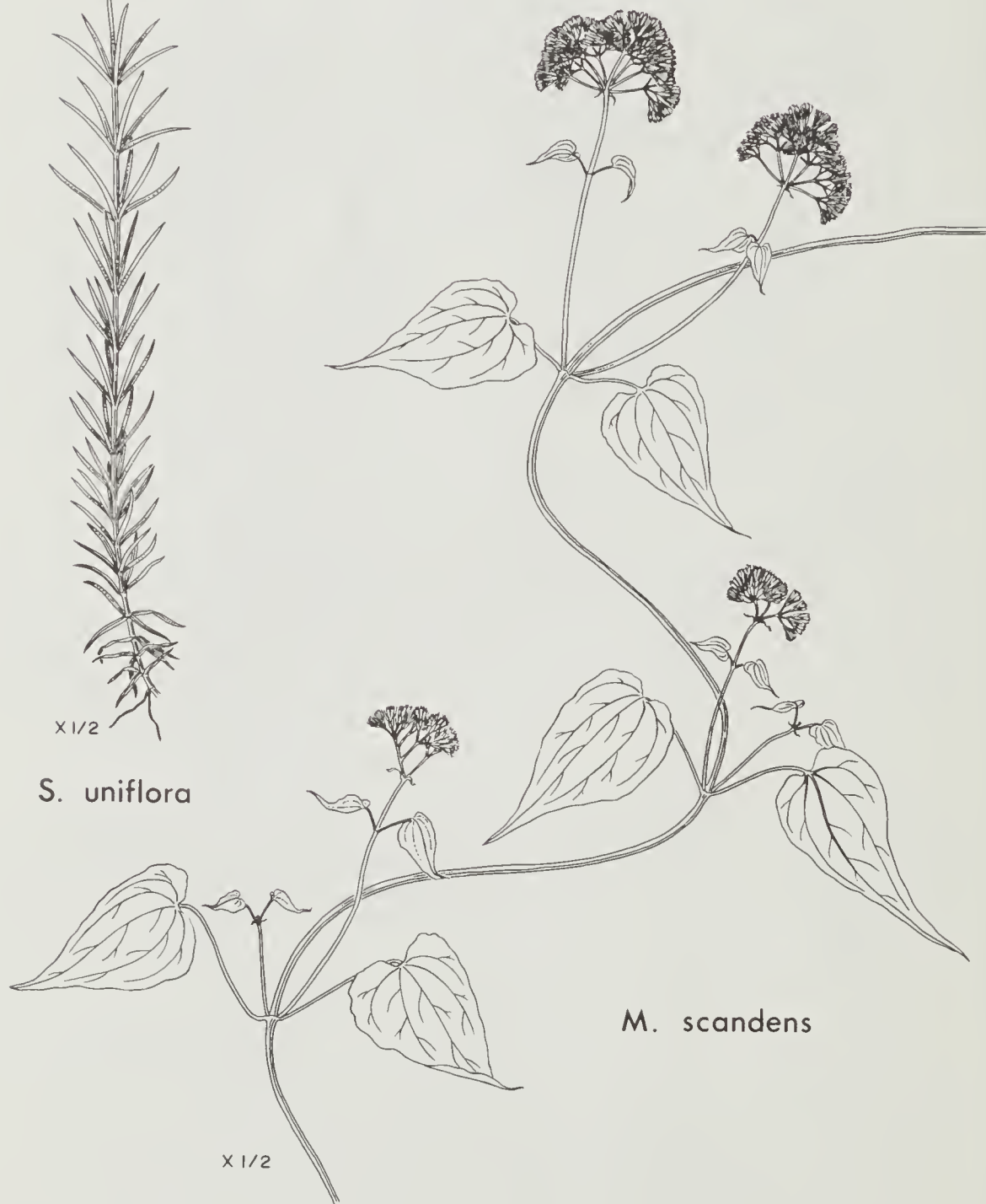


*I. frutescens*





*S. uniflora*



*M. scandens*

- c. Nutlet straight and flat, without corky wings, not strongly keeled; marginal awns 2.8-4.5 mm long; chaff reddish-tipped; ray flowers 1.5-3 cm long.....3. *B. laevis*
- a. Blades of leaves deeply divided or compound.
  - d. Awns of nutlet barbed downward.
    - e. Outer bracts 10 or more.....4. *B. vulgata*
    - e. Outer bracts 8 or less.....5. *B. frondosa*
  - d. Awns of nutlet, if barbed, barbed upward.
    - f. Outer bracts much longer than the inner, dilated upward; terminal leaf division more than 1 cm wide..  
.....5. *B. frondosa*
    - f. Outer bracts equal to or shorter than the inner; terminal leaf division usually less than 1 cm wide.
      - g. Nutlet not ciliate, less than 5 mm long.....6. *B. mitis*
      - g. Nutlet ciliate (perhaps sparsely), more than 5 mm long.
        - h. Flower stalk glabrous toward the top; nutlet ciliate on the edge but without wing-like margins.....7. *B. coronata*
        - h. Flower stalk pubescent at least toward the top; nutlet with thin ciliate, wing-like margins.
          - i. Outer bracts glabrous to finely ciliate, shorter than the inner; outer nutlets 3.3-5.2 mm broad, the inner 2.5-4.6 mm broad.....8. *B. aristosa*
          - i. Outer bracts coarsely ciliate, equal to or slightly longer than the inner; outer nutlets 2.5-2.8 mm broad, the inner 1.8-2.8 mm broad.....9. *B. polylepsis*

1. *Bidens tripartita* L.

Infrequent in low ground, bogs, and marshes in the Blue Ridge and Piedmont provinces of North Carolina. An introduction from Europe that is now established over much of the United States. [*B. connata* Muhl., *B. comosa* (Gray) Wieg.]

2. *Bidens cernua* L.

Infrequent in low ground, bogs, and marshes in the Blue Ridge Province of North Carolina. Extending northward into Maine, southward into Georgia and westward to the Pacific coastal states.

3. *Bidens laevis* (L.) BSP.

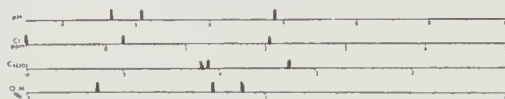
Infrequent in low ground, marshes, and along streams chiefly in the outer Coastal Plain of North Carolina. Extending northward into New Hampshire, southward into Florida and westward into Texas; locally inland into Indiana and West Virginia.

4. *Bidens vulgata* Greene

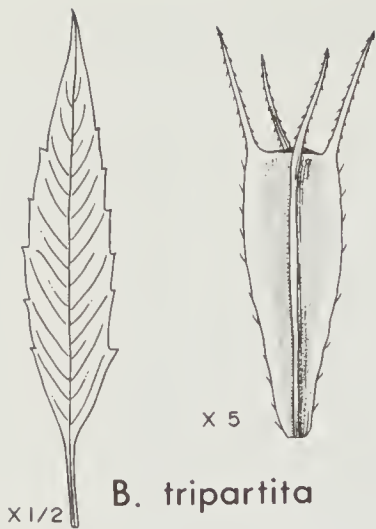
Infrequent in low ground, ditches, and marshes chiefly in the Blue Ridge Province of North Carolina. Extending northward into Maine southward into Georgia and westward into Washington, Nevada, Kansas, Missouri, and Tennessee.

5. *Bidens frondosa* L.

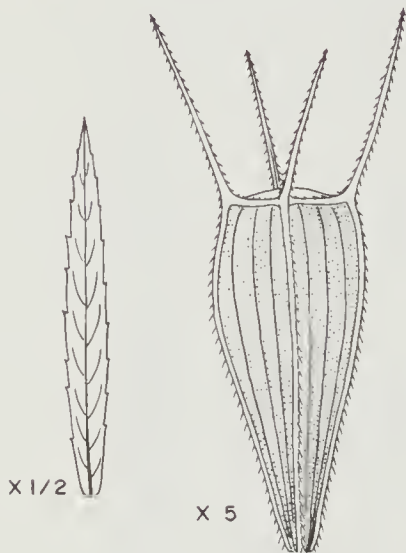
Common in low ground and marshes throughout North Carolina. Extending essentially throughout the United States.



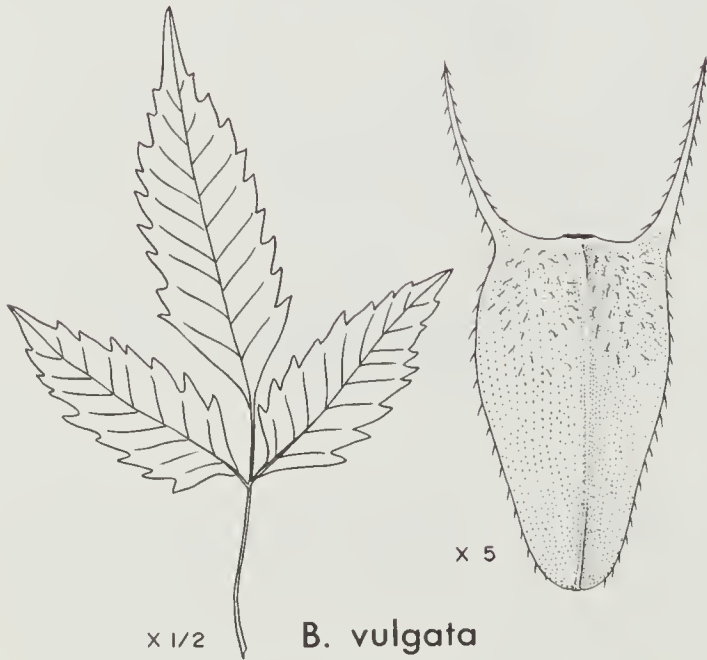
BIDENS



*B. tripartita*



*B. laevis*



*B. vulgata*



*B. cernua*

6. *Bidens mitis* (Michx.) Sherff  
 Infrequent in fresh or brackish swamps and marshes chiefly in the outer Coastal Plain of North Carolina. Extending, along the Atlantic and Gulf coastal states, from Maryland into Florida and Texas.

7. *Bidens coronata* (L.) Britt.  
 Infrequent in swamps and fresh to brackish marshes in Beaufort, Chowan, Craven, and Tyrrell counties of North Carolina. Extending northward into Massachusetts, southward into Florida and westward into Wisconsin, Nebraska, and Kentucky.

8. *Bidens aristosa* (Michx.) Britt.  
 Frequent in low ground, ditches, and marshes chiefly in the Piedmont and Coastal Plain provinces of North Carolina. Extending northward into Maine, southward into South Carolina and westward into Minnesota and Texas.

9. *Bidens polylepis* Blake  
 Infrequent in low ground, ditches, bogs, and marshes throughout North Carolina. Extending northward into Virginia, southward into Georgia and westward into Indiana, Illinois, Iowa, Colorado, Oklahoma, Missouri, and Texas.

11. ECLIPTA

1. *Eclipta alba* (L.) Hassk.  
 Common in low ground, ditches, and margins of ponds and streams chiefly in the Piedmont and Coastal Plain provinces of North Carolina. Extending northward into Massachusetts, southward into Florida and westward into Wisconsin, Iowa, Nebraska, and Texas. [*Verbesina alba* L.]



BIDENS

ECLIPTA



*B. frondosa*



*B. mitis*



*B. coronata*



*B. aristosa*



*B. polylepis*



*E. alba*



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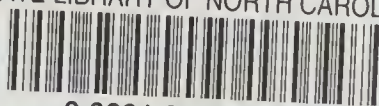
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